White Star

Air Quality Test Report

EPA Compliance Test for Particulate Matter and Lead Emissions

A717
Herculaneum
MOD006266373
2.0
SRC 12-3-02

 # 7 Blast Furnace Bldg.
 # 8 Refinery Process Kettles
 # 9 Refinery Bldg.

40170861
SUPERFUND RECORDS

Doe Run Company
881 Main Street
Herculaneum, Missouri

Test Date(s): December 3-5, 2002

MEMPHIS, TENNESSEE - HOUSTON, TEXAS

Main Office: P.O. Box 238 • Olive Branch, MS 38654 • Toll Free (888) 835-9815 • (662) 893-3063 • Fax (662) 895-1651
Visit Our Web Site At: www.whitestar-env.com

THE
DOE RUN
COMPANY
Herculaneum Smelting Division
ISO 9002 Certified

Aaron Miller
Environmental Manager
amiller@doerun.com

April 9, 2003

Mr. Bruce Morrison
USEPA Region VII
901 North 5th
Kansas City, KS 66101

Re: Herculaneum Stack Testing

Dear Bruce:

Enclosed you will find our test report of the stack testing conducted in late January. An earlier attempt had been made in December, but due to sampling equipment problems (ice like formations in the sample probe, umbilical cord, and the impinger train) the stack sampling was canceled. The next available date(s) that were mutually agreeable to the agencies and a different stack sampling company (Aeromet) was in late January 2003.

The sample data from the laboratory was not received at Aeromet's offices until late February. During the interim, the Missouri Department of Natural Resources Air Pollution Control Program (MDNR-APCP) requested additional information be added to the sampling report we did for them in 2002. In an effort to produce a report that was more acceptable to MDNR-APCP, the agency that actually oversaw the stack testing in January, it was thought better to understand the information that the MDNR-APCP wanted to see reflected in the stack sampling report rather than produce another report that was lacking in some information that the MDNR-APCP.

We believe that the enclosed report now contains that information to their satisfaction. Should you have any questions concerning the report, please feel free to contact me at your earliest convenience at 636-933-3180.

Sincerely,

Aaron W. Miller

Aaron W. Miller
Environmental Manager
Primary Smelting

AWM|slp

cc: Clifton Gray, The Doe Run Company
Doug Elley, MDNR-APCP

881 Main Street, Herculaneum, MO 63048
Telephone: 636-933-3180
Fax: 636-933-3150

Table of Contents

Page

Executive Summary.. 1

Introduction.. 2

Summary of Results.. 4
#7 Blast Furnace Bldg. BH.. 4
 # 8 Refinery Process Kettles BH...................................... 5
 # 9 Refinery Bldg. BH.. 6

Test Procedures & Specifications... 7

Calculations.. 11
#7 Blast Furnace Bldg. BH.. 11
 # 8 Refinery Process Kettles BH...................................... 17
 # 9 Refinery Bldg. BH.. 23

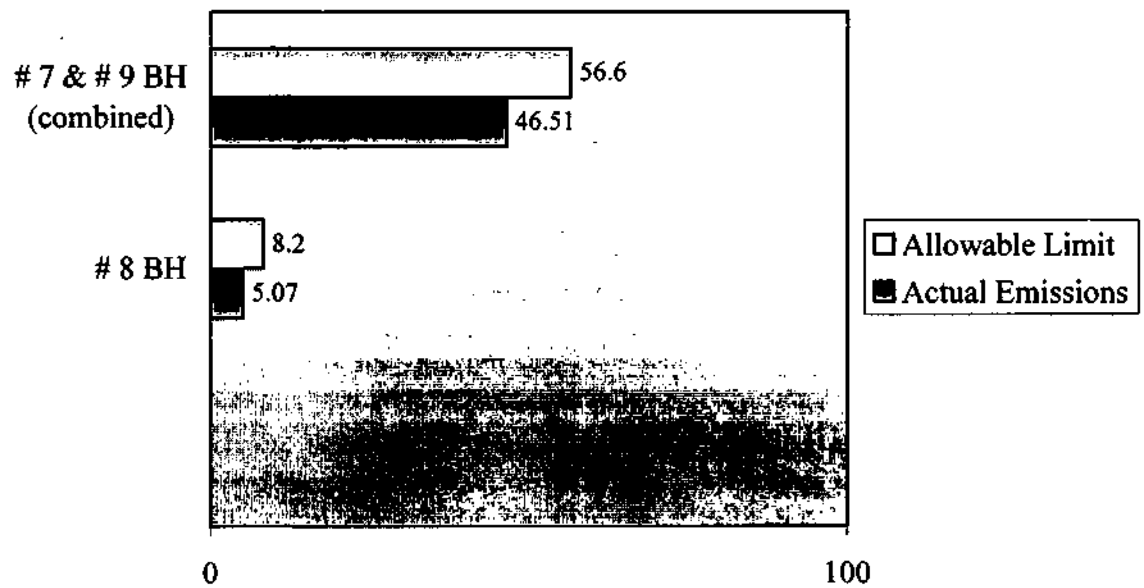
Appendices

Appendix A - Diagrams
Source Dimensions / Traverse Point Diagram
Sample Train Schematic(s)
Appendix B - Analysis Results (PM/Pb)
Pb Analysis Reports
PM Analysis Reports
Chain of Custody Records
Appendix C - Field Data Records
Appendix D - Equipment Calibrations
Appendix E - Certifications
Appendix F - Related Correspondence
Appendix G - Process Data

Executive Summary

White Star Environmental conducted air quality testing at Doe Run Company, a primary lead smelting plant, located in Herculaneum, Missouri. Three process systems: (1) # 7 Blast Furnace Bldg. baghouse, (2) # 8 Refinery Process Kettles baghouse, and (3) the # 9 Refinery Bldg. baghouse were sampled for particulate matter and lead emissions. The testing was performed during the period December 3-5, 2002 and serves as demonstration of compliance for emissions regulated by EPA and the State of Missouri.

Doe Run Company – Herculaneum, MO
Lead (Pb) Emissions
(lb / 24 hr)



Based on these test results the individual processes designated as the # 8 Refinery Process Kettles, # 9 Refinery Bldg. Baghouse, and the # 7 Blast Furnace Bldg. Baghouse are operating within the specified limits for lead emissions.

Introduction

Doe Run Company, located in Herculaneum, Missouri is operating a primary lead smelting facility, which produces lead from lead sulfide ore concentrates through pyro-metallurgical techniques. The Missouri Department of Natural Resources regulates this facility in the quality of air it exhausts to the atmosphere. MDNR Division 10 – Air Conservation Commission establishes the regulatory limitations through CSR 10-6.120.

The *sintering process* is accomplished utilizing a sintering furnace. The lead sulfide ore concentrate charge is heated in the presence of air to eliminate sulfur contained in the charge. The feed material consists of lead concentrate, iron ore, silica sand, limestone, and coke breeze. Metal conveyor belts route the feedstock through the sinter machine where the material ultimately agglomerates into a hard porous mass called sinter.

The *Blast Furnace* is a reduction process to which sinter is charged and forms separate layers of molten slag and lead bullion. The Blast Furnace is charged with feed materials consisting of sinter material and refinery drosses. Lead bullion is tapped continuously into a pot where it is then transferred by crane to the dross kettles. Ventilation hoods located over the pot control emissions from the tapping operations. The slag is tapped into a slag generator where it is palletized by water injection. After de-watering the slag with high lead content is conveyed back to the sintering machine.

As part of the requirements for ensuring air quality compliance, three processes involved in the control of emissions from the production of lead bullion at the facility were sampled for pollutant emissions, *(1) # 8 Refinery Process Kettles baghouse, (2) # 9 Refinery Bldg. baghouse, and (3) the # 7 Blast Furnace Bldg. baghouse*. The limitations on air pollutants from the facility are provided below.

The #7 baghouse ventilates the combined Blats Furnace and Dross Plant building fugitives. Two blast furnaces are present at the facility. The furnaces are water-jacketed to within 5 feet of the charge floor, and above that, they are lined with refractory. Both are equipped with center line off takes for their process gas streams to a separate #5 baghouse and Main Stack. Emissions from the # 7 Blast Furnace Bldg. Baghouse are controlled using eight Wheelabrator dust collectors in a 8x1 arrangement. This control device is designed to manage 300,000 acfm at full load.

The # 8 baghouse filters air from the kettle hoods in the Refinery and the CV-10 Belt under the Stock Sinter Storage Hoppers. The Refinery is basically a batch process where kettles are worked in batches of roughly 250 tons per batch before moving to another kettle. The emissions related to the # 8 Refinery Process Kettles are controlled using a Wheelabrator Dust Collector arranged in a 5x1 configuration. . This control device is designed to manage 90,000 acfm at full load.

The #9 baghouse ventilates the Refinery building fugitives. Lead is pumped and laundered into the Refining department, which is equipped with eleven 250-ton kettles. Each kettle is heated by one gas-fired burner, which is on a separate ventilation system. Lead is pumped through the sequential kettle series, culminating in delivery of refined lead to casting machines. The emissions related to the # 9 baghouse are controlled using a Wheelabrator Dust Collector arranged in a 5x1 configuration. . This control device is designed to manage 250,000 acfm at full load.

Pollutant emissions from the facility are regulated by the Missouri Department of Natural Resources. The SIP requires lead testing and analysis however the particulate matter testing data were obtained for informational purposes and the results are included herein. Mr. Peter Yronwode, represented the Missouri Department of Natural Resources. The following table provides the applicable limits for each targeted process.

Allowable Limits Summary

Process	**Lead (Pb)** lbs/24 hours
# 8 Baghouse	**8.2**
# 7 & # 9 Baghouse (combined)	**56.6**

White Star Environmental performed the emissions test on the process exhaust stream(s) on December 3-5, 2002. Mr. Scott Postma with the Environmental Protection Agency witnessed the testing.

Test Results Summary

7 Blast Furnace Bldg. Baghouse

Particulate & Lead Emissions Summary
December 3, 2002

Test	Particulate Matter (PM)			Lead (Pb)		
	Conc. Gr/dscf	Emission lb/hr	Emission lbs per 24 hr	Conc. Gr/dscf	Emission Lb/hr	Emission lbs per 24 hr
1	0.0029	7.40	177.55	0.00008	0.196	4.71
2	0.0043	11.04	265.00	0.00026	0.680	16.32
3	0.0034	9.02	216.49	0.00024	0.619	14.86
Avg.	0.0035	9.15	219.68	0.00019	0.500	11.96
Limit		-		-		56.6

Exhaust Gas Summary

Parameter	Run 1	Run 2	Run 3	Average
Start Time	10:30	12:22	14:46	-
End Time	11:38	13:30	15:54	-
Sample time, min.	60	60	60	60
Gas volume sampled, dscf	44.665	45.093	45.694	45.15
Barometric pressure, in. Hg	29.8	29.8	29.8	29.8
Static pressure, in. H_2O	-10.0	-10.0	-10.0	-10.0
Stack pressure, in. Hg	29.06	29.06	29.06	29.06
Gas moisture, %	1.04	1.03	0.92	1.00
Oxygen, %	20.9	20.9	20.9	20.9
Carbon dioxide, %	0.0	0.0	0.0	0.0
Nitrogen, %	79.1	79.1	79.1	79.1
Gas dry mol. wt., lb/lb-mole	28.84	28.84	28.84	28.84
Actual gas mol. wt., lb/lb-mole	28.72	28.72	28.74	28.73
Gas temperature, °F	41	43	42	42
Gas velocity, ft/sec.	51.70	51.92	52.50	52.04
Gas vol. flow, dscf/hr	18,095,546	18,105,763	18,367,994	18,189,768
Isokinetic Variation, %	96.19	97.06	96.95	96.73

Test Results Summary

8 Refinery Process Kettles

Particulate Matter & Lead Emissions
December 5, 2002

Test	Particulate Matter (PM)			Lead (Pb)		
	Conc. Gr/dscf	Emission lb/hr	Emission lbs per 24 hr	Conc. Gr/dscf	Emission lb/hr	Emission lbs per 24 hr
1	0.00245	1.724	41.38	0.00047	0.33	7.88
2	0.00378	2.643	63.44	0.00030	0.21	5.05
3	0.00223	1.583	37.98	0.00013	0.10	2.29
Avg.	0.00282	1.983	47.60	0.00030	0.21	5.07
Limit	-	-	-	-	-	8.2

Exhaust Gas Summary

Parameter	Run 1	Run 2	Run 3	Average
Start Time	10:15	11:50	13:50	-
End Time	11:17	12:51	14:51	-
Sample time, min.	60	60	60	60
Gas volume sampled, dscf	39.612	39.891	39.994	39.83
Barometric pressure, in. Hg	30.1	30.1	30.1	30.1
Static pressure, in. H_2O	0.20	0.24	0.22	0.22
Stack pressure, in. Hg	30.11	30.12	30.12	30.12
Gas moisture, %	0.47	0.59	0.47	0.51
Oxygen, %	20.9	20.9	20.9	20.9
Carbon dioxide, %	0.0	0.0	0.0	0.0
Nitrogen, %	79.1	79.1	79.1	79.1
Gas dry mol. wt., lb/lb-mole	28.84	28.84	28.84	28.84
Actual gas mol. wt., lb/lb-mole	28.78	28.77	28.79	28.78
Gas temperature, °F	53	57	52	54
Gas velocity, ft/sec.	23.38	23.34	23.45	23.39
Gas vol. flow, dscf/hr	4,927,073	4,890,445	4,960,585	4,926,034
Isokinetic Variation, %	99.55	101.00	99.83	100.12

Test Results Summary

9 Refinery Bldg. Baghouse

Particulate Matter & Lead Emissions
December 4, 2002

Test	Particulate Matter (PM)			Lead (Pb)		
	Conc. gr/dscf	Emission lb/hr	Emission lb/hr per day	Conc. gr/dscf	Emission lb/hr	Emission lb/hr per day
1	0.0024	5.09	122.05	0.00149	3.124	74.97
2	0.0029	5.94	142.67	0.00034	0.702	16.85
3	0.0020	4.20	100.72	0.00024	0.493	11.84
Avg.	0.0024	5.08	121.81	0.00069	1.44	34.55
Limit	-	-	-	-	-	56.6

Exhaust Gas Summary

Parameter	Run 1	Run 2	Run 3	Average
Start Time	9:48	12:37	14:56	-
End Time	10:56	13:45	16:04	-
Sample time, min.	60	60	60	60
Gas volume sampled, dscf	44.497	44.820	43.570	44.30
Barometric pressure, in. Hg	30.2	30.2	30.2	30.2
Static pressure, in. H_2O	-10.0	-10.0	-10.0	-10.0
Stack pressure, in. Hg	29.46	29.46	29.46	29.46
Gas moisture, %	0.74	0.73	0.75	0.74
Oxygen, %	20.9	20.9	20.9	20.9
Carbon dioxide, %	0.0	0.0	0.0	0.0
Nitrogen, %	79.1	79.1	79.1	79.1
Gas dry mol. wt., lb/lb-mole	28.84	28.84	28.84	28.84
Actual gas mol. wt., lb/lb-mole	28.75	28.75	28.75	28.75
Gas temperature, °R	38	36	38	37
Gas velocity, ft/sec.	50.10	49.56	49.66	49.77
Gas vol. flow, dscf/hr	14,693,663	14,590,924	14,581,830	14,622,139
Isokinetic Variation, %	96.41	97.79	95.12	96.44

Test Procedures & Specifications

Determination of Lead Emissions From Stationary Sources
EPA REFERENCE METHOD 12 (40 CFR 60, App A)

Forward

The following summary provides discussion of the testing procedures specific to this project. All equipment and methodology adhered to Method 12 requirements unless specified herein. Any deviations from these specifications are noted in bold print. The detailed sampling and analysis procedure is provided in 40 CFR 60, Appendix A.

General

Particulate and gaseous Pb emissions were sampled isokinetically (sample rate equals gas stream linear velocity) from the source and collected on a filter and in dilute nitric acid. The collected samples are digested in acid solution and are analyzed by atomic absorption spectrophotometry using an air/acetylene flame.

Equipment Specifications

A schematic of the sampling train used in performing this method is shown later in this section.

Probe Nozzle – Glass nozzles with a sharp, tapered leading edge were utilized. The angle of taper was 30 degrees and the taper is on the outside to preserve a constant internal diameter. The nozzles were button-hook design.

Probe Liner –Teflon was employed versus using a glass liner. No bias is expected to result from this modification.

Pitot Tube (Type S) - The pitot tube is attached to the probe to allow constant monitoring of the stack gas velocity. The impact (high pressure) opening plane of the pitot tube is even with or above the nozzle entry plane during sampling. The Type S pitot tube assembly was calibrated and assigned a coefficient of 0.84 according to Method 2.

Differential Pressure Gauge – A dual inclined manometer was employed for (1) velocity head (Δp) readings and (2) orifice differential (ΔH) pressure readings. The horizontal scale is 0 - 1 in. H_2O and the vertical scale provided readings in the 1 - 10 in. H_2O range.

Filter Holder & Heating System – A stainless steel in-stack filter device was employed during the procedures. This alteration from the standard practice of using an external heated filter assembly was due to vertical sampling traverses in conjunction with using extensive probe length, which was necessary for the traverse distances. The holder design provides a positive seal against leakage from the outside or around the filter. The holder is attached immediately at the inlet to the probe and is maintained at the stack temperature during sampling.

Metering System - An Apex Instruments Metering Console MC-522 includes a vacuum gauge, pump, dry gas meter (DGM) and related equipment.

Barometer - The barometric pressure reading(s) were obtained from the National Weather Service station located in nearby Farmington, Missouri.

Condensing System - Four impingers connected in series were placed in an ice bath and were utilized to condense moisture vapor and collect pollutant material from the gas stream. The sample train schematic provides a description of these devices.

Reagents and Standards

Filter. Advantec MFS, Inc. thimble filters, 19x90 mm, Grade 86R. A blank filter was submitted to the laboratory for lead analysis with the collected samples.

Water. Deionized distilled, conforms to ASTM D 1193-77 or 91, Type 3.

Acetone. Reagent grade, < 0.001 percent residue, in glass bottles.

Nitric Acid (0.1 N HNO_3), Reagent grade.

Sample Collection

Sampling Train Preparation. The impingers were prepared with 0.1 N HNO_3 in accordance with Method 12 requirements. As the gas stream bubbles through the HNO_3 solution the lead is extracted from the gas stream.

Leak-Check Procedures The sampling train was leak-checked prior to each test run, during changes from ports, and at the conclusion of each test run. The nozzle was plugged and a vacuum higher than encountered during the test was pulled on the system. If the leakage rate is found to be less than 0.020 cfm or 4 percent of the average sampling rate (whichever is less), the results are acceptable and no correction need be applied to the volume of gas metered.

Cyclonic Flow Test The absence of cyclonic flow test was performed on each emission source. The rotation angle was measured at each traverse point and the average value calculated. The sampling location is determined to be free of cyclonic flow if the average rotation angle is less than 20 %. All test values for the sampling locations met this value. The cyclonic flow test data sheets are provided in the appendix section of this report.

Sampling Train Operation The nozzle was placed at each traverse point as identified in the enclosed Source Diagram and the pump rate was set to perform isokinetic sampling. The clock time, sample vacuum, stack gas temperature, DGM volume & temperatures, impinger exit temperature, velocity head (Δp), orifice differential pressure (ΔH) were recorded at each traverse point. During periods of changing ports, the metering system was stopped, leak-checked, and managed in such a manner as to prevent contaminants into the system. The isokinetic percentage of each sampling period was determined to be within the $\pm$ 10 % limit.

Sample Recovery Doe Run Company provided laboratory facilities for sample recovery activities. The thimble filter was removed from the holder and sealed in a labeled plastic bag. The impinger contents were measured for volume (ml) gain using a graduated cylinder and then transferred to a 250 ml Qorpak sample bottle labeled "Imp Catch". All system components from the nozzle through the impinger system was rinsed according to Method 12 and collected in a separate 250 ml Qorpak sample bottle labeled "Imp Wash". The silica gel was weighed on-site using a triple beam balance.

Calibration

Equipment calibration records are provided in the Appendix section of this report.

Probe Nozzle. Probe nozzles shall be calibrated before their initial use in the field. Using a micrometer, measure the ID of the nozzle to the nearest 0.025 mm (0.001 in.). Make three separate measurements using different diameters each time, and obtain the average of the measurements. The difference between the high and low numbers shall not exceed 0.1 mm (0.004 in.). When nozzles become nicked, dented, or corroded, they shall be reshaped, sharpened, and recalibrated before use. Each nozzle shall be permanently and uniquely identified.

Pitot Tube Assembly. The Type S pitot tube assembly shall be calibrated according to the procedure outlined in Method 2.

Metering System. The metering system is calibrated before and after each test project using a wet test meter accurate to within 1 percent. The wet test meter has a capacity of 30 liters/rev (1 ft^3/rev). This calibration is performed at each of five orifice manometer settings. The DGM calibration factor, Y, and the orifice calibration factor, $\Delta H_{@}$, are determined and utilized in the emission calculations.

Analytical Procedures

Sample analysis is performed using an atomic absorption spectrophotometer (AAS), which determines the absorbance for each sample. Each sample is analyzed in triplicate and the average value reported. Appropriate dilutions are made, as needed, to bring all sample Pb concentrations into the linear absorbance range of the spectrophotometer. For each source sample, the average absorbance for the contribution of the filter blank and the 0.1 N HNO_3 blank is corrected. Use the calibration curve and this corrected absorbance to determine the Pb concentration in the sample aspirated into the spectrophotometer. Calculate the total Pb content m_t (in μg) in the original source sample; correct for all the dilutions that were made to bring the Pb concentration of the sample into the linear range of the spectrophotometer.The analysis protocol and chain of custody form submitted with the samples is provided in the Appendix Section of this report.

Method Performance

Precision. The within-laboratory precision, as measured by the coefficient of variation, ranges from 0.2 to 9.5 percent relative to a run-mean concentration. These values were based on tests conducted at a gray iron foundry, a lead storage battery manufacturing plant, a secondary lead smelter, and a lead recovery furnace of an alkyl lead manufacturing plant. The concentrations encountered during these tests ranged from 0.61 to 123.3 mg Pb/m^3.

Analytical Range. For a minimum analytical accuracy of ±10 percent, the lower limit of the range is 100 μg. The upper limit can be extended considerably by dilution.

Analytical Sensitivity. Typical sensitivities for a 1-percent change in absorption (0.0044 absorbance units) are 0.2 and 0.5 μg Pb/ml for the 217.0 and 283.3 nm lines, respectively.

Alternative Procedures (EPA Method 12)

Simultaneous Determination of Particulate and Lead Emissions. Method 5 may be used to simultaneously determine Pb provided: (1) acetone is used to remove particulate from the probe and inside of the filter holder as specified by Method 5, (2) 0.1 N HNO_3 is used in the impingers, (3) a glass fiber filter with a low Pb background is used, and (4) the entire train contents, including the impingers, are treated and analyzed for Pb as described in this method.

Calculations

The following section provides a detailed description of all calculations used in the determination of emission rates. Also listed are all of the intermediate values associated with these calculations.

7 Blast Furnace Bldg. Baghouse

Dry Gas Meter Volume

$$V_{m(std)} = Vm\left[\frac{T_{STD}}{T_m}\right]\left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{P_{std}}\right] = 17.64[Y][V_m]\left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right]$$

Parameter	Run 1	Run 2	Run 3
Vm	42.506	42.88	43.356
Tm	503	502	501
Pbar	29.06	29.06	29.06
ΔH avg	1.85	1.86	1.92
C Factor (Y)	1.036	1.036	1.036
Vm std	44.665	45.093	45.694

Nomenclature

ΔH = Average pressure drop across orifice, in. H_2O.
P_{bar} = Barometric pressure, in. Hg.
T_m = Absolute gas meter temperature, °R
V_m = Dry gas volume measured, ft^3
Y = Dry gas meter calibration factor
$V_{m(std)}$ = Dry gas volume corrected to dry, standard conditions, ft^3

7 Blast Furnace Bldg. Baghouse

Water Vapor Condensed

$$V_{wcstd} = \left[\frac{P_w \bullet R \bullet T_{std}}{M_w \bullet P_{std}}\right][V_f - V_i] = 0.04707[V_f - V_i]$$

$$V_{wsgstd} = \left[\frac{R \bullet T_{std}}{M_w \bullet P_{std}}\right][W_f - W_i] = 0.04715[W_f - W_i]$$

Moisture Content

$$B_{ws} = \left[\frac{V_{wcstd} + V_{wsgstd}}{V_{wcstd} + V_{wsgstd} + V_{mstd}}\right] \bullet 100$$

Parameter	Run 1	Run 2	Run 3
V_{wc}	0.282	0.188	0.235
V_{wsg}	0.189	0.283	0.189
Bws, %	1.04	1.03	0.92

Nomenclature:

B_{ws} = Water vapor, by volume, in gas stream, %
ΔH = Average pressure drop across orifice, in. H_2O.
P_{bar} = Barometric pressure, in. Hg.
T_m = Absolute gas meter temperature, °R
V_f, V_i = Impinger system volume, final & initial, ml
V_m = Dry gas volume measured, ft^3
$V_{m(std)}$ = Dry gas volume corrected to dry, standard conditions, ft^3
$V_{wc(std)}$ = Water vapor condensed, ml
$V_{wsg(std)}$ = Water vapor captured in silica gel, g
W_f, W_i = Silica gel weight, final & initial, g
Y = Dry gas meter calibration factor
0.04707 = Conversion factor, ft^3/ml
0.04715 = Conversion factor, ft^3/g

7 Blast Furnace Bldg. Baghouse

Dry Molecular Weight

$$M_d = 0.44[\%CO_2] + 0.32[\%O_2] + 0.28[\%CO+\%N_2]$$

Molecular Weight of Gas Stream

$$M_s = M_d \bullet \left[\frac{1-Bws}{100}\right] + 18 \bullet \left[\frac{Bws}{100}\right]$$

Parameter	Run 1	Run 2	Run 3
O2, %	20.9	20.9	20.9
CO2, %	0.0	0.0	0.0
CO + N2, %	79.1	79.1	79.1
Bws, %	1.04	1.03	0.92
Md, lb/lb-mole	28.84	28.84	28.84
Ms, lb/lb-mole	28.72	28.72	28.74

Nomenclature

B_{ws} = Water vapor, by volume, in gas stream, %
M_d = Dry molecular weight of gas stream, lb/lb-mole
M_s = Molecular weight of gas stream actual conditions, (lb/lb-mole)
$\%CO_2$ = Carbon dioxide concentration, by volume, %
$\%O_2$ = Oxygen concentration, by volume, %
$\%N_2$ = Nitrogen concentration, by volume, %
%CO = Carbon monoxide concentration, by volume, %
18 = Molecular weight of H_2O vapor, lb/lb-mole

7 Blast Furnace Bldg. Baghouse

Linear Velocity of Gas Stream

$$V_s = K_p C_p \left[\sqrt{\Delta P}\right]_{avg} \sqrt{\frac{T_s}{P_s M_s}}$$

Parameter	Run 1	Run 2	Run 3
Kp	85.49	85.49	85.49
Cp	0.84	0.84	0.84
SQRT (dP) avg	0.93	0.93	0.94
Ts, R	501	503	502
Ps	29.06	29.06	29.06
Vs	51.70	51.92	52.50

Volumetric Flow Rate of Gas Stream

$$Q_{sd} = 3600\left[1 - B_{ws}\right] V_s A \left[\frac{T_{std}}{T_s}\right]\left[\frac{P_s}{P_{std}}\right]$$

Parameter	Run 1	Run 2	Run 3
Bws, %	1.04	1.03	0.92
As, ft^2	96.00	96.00	96.00
Ts, R	501	503	502
Ps	29.06	29.06	29.06
Qsd, SCFH	18,095,546	18,105,763	18,367,994

Nomenclature

- A = Cross sectional area of gas stream, ft^2
- B_{ws} = Water vapor, by volume, in gas stream, %
- C_p = Calibration factor of pitot tube device, dimensionless
- ΔP = Pressure differential of gas stream, in H_2O
- K_p = 85.49 ft/sec[(lb/lb-mole•in. Hg)/(°K•in. H_2O)]$^{1/2}$
- M_s = Molecular weight of gas stream actual conditions, (lb/lb-mole)
- P_{bar} = Barometric pressure, in. Hg
- P_g = Static pressure of gas stream, in Hg
- P_s = Absolute pressure of gas stream, in. Hg (P_{bar}+P_g)
- P_{std} = Absolute standard pressure, 29.92 in. Hg
- Q_{sd} = Volumetric flow rate of gas stream, dry basis, std cond., ft^3/hr
- T_s = Absolute temperature of gas stream, ° R
- T_{std} = Absolute standard temperature, 528° R
- V_s = Linear velocity of gas stream, ft/sec.
- 3600 = Conversion factor, sec/hr.

7 Blast Furnace Bldg. Baghouse

Isokinetic Variation

$$I = 100 \bullet T_s \left[\frac{(0.002669)\left\{V_{ic} + \left(\frac{Y_i \bullet V_m}{T_m}\right)\left(P_{bar} + \frac{\Delta H}{13.6}\right)\right\}}{60 \bullet \Theta \bullet V_s \bullet P_s \bullet A_n} \right]$$

Parameter	Run 1	Run 2	Run 3
Ts, R	501	503	502
Vic	10	10	9
Yi	1.036	1.036	1.036
Vm	42.506	42.88	43.356
Tm	503	502	501
Pbar	29.06	29.06	29.06
dH avg	1.85	1.86	1.92
sampling time, min.	60	60	60
An	0.00024	0.00024	0.00024
I	96.19	97.06	96.95

Nomenclature

- I = Isokinetic variation, %
- T_s = Absolute temperature of gas stream, ° R
- V_{ic} = Water vapor condensed from gas stream, ml
- Y = Dry gas meter calibration factor
- V_m = Dry gas volume measured, ft^3
- T_m = Absolute gas meter temperature, °R
- P_{bar} = Barometric pressure, in. Hg.
- ΔH = Average pressure drop across orifice, in. H_2O.
- 13.6 = Inches of water per Hg.
- V_s = Linear velocity of gas stream, ft/sec.
- P_s = Absolute pressure of gas stream, in. Hg ($P_{bar}+P_g$)
- A_n = Cross sectional area of nozzle, ft^2

7 Blast Furnace Bldg. Baghouse

Pollutant Concentration & Emission Rate

$$Cs, gr/dscf = (0.0154\ gr/mg)(m_n)/(V_{m\ std})$$

$$E, lb/hr = (Cs)(Qsd)/(7000\ gr/lb)$$

$$E, lb/hr/24\ hr = (E, lb/hr)(24)$$

Particulate Matter

Parameter	Run 1	Run 2	Run 3
m_n, mg	8.3	12.5	10.2
$V_{m\ std}$, dscf	44.665	45.093	45.694
C_s, gr/dscf	0.0029	0.0043	0.0034
Q_{sd}, dscf/hr	18,095,546	18,105,763	18,367,994
E, lb/hr	7.40	11.04	9.02
E, lb/24 hr	177.6	265.0	216.5

Lead (Pb)

Parameter	Run 1	Run 2	Run 3
m_n, mg	0.22	0.77	0.70
$V_{m\ std}$, dscf	44.665	45.093	45.694
C_s, gr/dscf	0.00008	0.00026	0.00024
Q_{sd}, dscf/hr	18,095,546	18,105,763	18,367,994
E, lb/hr	0.196	0.680	0.619
E, lb/24 hr	4.71	16.32	14.86

Nomenclature

m_n = pollutant material collected, mg or ug
$V_{m(std)}$ = Dry gas volume corrected to dry, standard conditions, ft^3
Cs, gr/dscf = pollutant concentration, grains per dry standard cubic ft.
Q_{sd} = Volumetric flow rate of gas stream, dry basis, std cond., ft^3/hr
E, lb/hr = pollutant mass emission rate, pounds per hour
E, lb/hr/24 hr = pollutant mass emission rate, lb/hr per 24 hour period

Calculations

The following section provides a detailed description of all calculations used in the determination of emission rates for . Also listed are all of the intermediate values associated with these calculations.

8 Refinery Process Kettles

Dry Gas Meter Volume

$$V_{m(std)} = Vm\left[\frac{T_{STD}}{T_m}\right]\left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{P_{std}}\right] = 17.64[Y][V_m]\left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right]$$

Parameter	Run 1	Run 2	Run 3
Vm	37.404	37.723	37.625
Tm	503	504	501
Pbar	30.1	30.1	30.1
ΔH avg	1.42	1.42	1.43
C Factor (Y)	1.036	1.036	1.036
Vm std	39.612	39.891	39.994

Nomenclature

ΔH = Average pressure drop across orifice, in. H_2O.
P_{bar} = Barometric pressure, in. Hg.
T_m = Absolute gas meter temperature, °R
V_m = Dry gas volume measured, ft^3
Y = Dry gas meter calibration factor
$V_{m(std)}$ = Dry gas volume corrected to dry, standard conditions, ft^3

8 Refinery Process Kettles

Water Vapor Condensed

$$V_{wcstd} = \left[\frac{P_w \bullet R \bullet T_{std}}{M_w \bullet P_{std}}\right][V_f - V_i] = 0.04707[V_f - V_i]$$

$$V_{wsgstd} = \left[\frac{R \bullet T_{std}}{M_w \bullet P_{std}}\right][W_f - W_i] = 0.04715[W_f - W_i]$$

Moisture Content

$$B_{ws} = \left[\frac{V_{wcstd} + V_{wsgstd}}{V_{wcstd} + V_{wsgstd} + V_{mstd}}\right] \bullet 100$$

Parameter	Run 1	Run 2	Run 3
V_{wc}	0.047	0.047	0.094
V_{wsg}	0.141	0.189	0.094
Bws, %	0.47	0.59	0.47

Nomenclature:

B_{ws} = Water vapor, by volume, in gas stream, %
ΔH = Average pressure drop across orifice, in. H_2O.
P_{bar} = Barometric pressure, in. Hg.
T_m = Absolute gas meter temperature, °R
V_f, V_i = Impinger system volume, final & initial, ml
V_m = Dry gas volume measured, ft^3
$V_{m(std)}$ = Dry gas volume corrected to dry, standard conditions, ft^3
$V_{wc(std)}$ = Water vapor condensed, ml
$V_{wsg(std)}$ = Water vapor captured in silica gel, g
W_f, W_i = Silica gel weight, final & initial, g
Y = Dry gas meter calibration factor
0.04707 = Conversion factor, ft^3/ml
0.04715 = Conversion factor, ft^3/g

8 Refinery Process Kettles

Dry Molecular Weight

$$M_d = 0.44[\%CO_2] + 0.32[\%O_2] + 0.28[\%CO+\%N_2]$$

Molecular Weight of Gas Stream

$$M_s = M_d \bullet \left[\frac{1-Bws}{100}\right] + 18 \bullet \left[\frac{Bws}{100}\right]$$

Parameter	Run 1	Run 2	Run 3
O2, %	20.9	20.9	20.9
CO2, %	0.0	0.0	0.0
CO + N2, %	79.1	79.1	79.1
Bws, %	0.47	0.59	0.47
Md, lb/lb-mole	28.84	28.84	28.84
Ms, lb/lb-mole	28.78	28.77	28.79

Nomenclature

B_{ws} = Water vapor, by volume, in gas stream, %
M_d = Dry molecular weight of gas stream, lb/lb-mole
M_s = Molecular weight of gas stream actual conditions, (lb/lb-mole)
$\%CO_2$ = Carbon dioxide concentration, by volume, %
$\%O_2$ = Oxygen concentration, by volume, %
$\%N_2$ = Nitrogen concentration, by volume, %
%CO = Carbon monoxide concentration, by volume, %
18 = Molecular weight of H_2O vapor, lb/lb-mole

8 Refinery Process Kettles

Linear Velocity of Gas Stream

$$V_s = K_p C_p \left[\sqrt{\Delta P}\right]_{avg} \sqrt{\frac{T_s}{P_s M_s}}$$

Parameter	Run 1	Run 2	Run 3
Kp	85.49	85.49	85.49
Cp	0.84	0.84	0.84
SQRT (dP) avg	0.42	0.42	0.43
Ts, R	513	517	512
Ps	30.11	30.22	30.22
Vs	23.38	23.34	23.45

Volumetric Flow Rate of Gas Stream

$$Q_{sd} = 3600\left[1 - B_{ws}\right] V_s A \left[\frac{T_{std}}{T_s}\right]\left[\frac{P_s}{P_{std}}\right]$$

Parameter	Run 1	Run 2	Run 3
Bws, %	0.47	0.59	0.47
As, ft^2	56.74	56.74	56.74
Ts, R	513	517	512
Ps	30.11	30.22	30.22
Qsd, SCFH	4,927,073	4,890,445	4,960,585

Nomenclature

A = Cross sectional area of gas stream, ft^2
B_{ws} = Water vapor, by volume, in gas stream, %
C_p = Calibration factor of pitot tube device, dimensionless
ΔP = Pressure differential of gas stream, in H_2O
K_p = 85.49 ft/sec[(lb/lb-mole•in. Hg)/(°K•in. H_2O)]$^{1/2}$
M_s = Molecular weight of gas stream actual conditions, (lb/lb-mole)
P_{bar} = Barometric pressure, in. Hg
P_g = Static pressure of gas stream, in Hg
P_s = Absolute pressure of gas stream, in. Hg (P_{bar}+P_g)
P_{std} = Absolute standard pressure, 29.92 in. Hg
Q_{sd} = Volumetric flow rate of gas stream, dry basis, std cond., ft^3/hr
T_s = Absolute temperature of gas stream, ° R
T_{std} = Absolute standard temperature, 528° R
V_s = Linear velocity of gas stream, ft/sec.
3600 = Conversion factor, sec/hr.

8 Refinery Process Kettles

Isokinetic Variation

$$I = 100 \bullet T_s \left[\frac{(0.002669)\left\{ V_{ic} + \left(\frac{Y_i \bullet V_m}{T_m} \right) \left(P_{bar} + \frac{\Delta H}{13.6} \right) \right\}}{60 \bullet \Theta \bullet V_s \bullet P_s \bullet A_n} \right]$$

Parameter	Run 1	Run 2	Run 3
Ts, R	513	517	512
Vic	4	5	4
Yi	1.036	1.036	1.036
Vm	37.404	37.723	37.625
Tm	503	504	501
Pbar	30.1	30.1	30.1
dH avg	1.42	1.42	1.43
sampling time, min.	60	60	60
An	0.000458	0.000458	0.000458
I	99.55	101.00	99.83

Nomenclature

- I = Isokinetic variation, %
- T_s = Absolute temperature of gas stream, ° R
- V_{ic} = Water vapor condensed from gas stream, ml
- Y = Dry gas meter calibration factor
- V_m = Dry gas volume measured, ft^3
- T_m = Absolute gas meter temperature, °R
- P_{bar} = Barometric pressure, in. Hg.
- ΔH = Average pressure drop across orifice, in. H_2O.
- 13.6 = Inches of water per Hg.
- V_s = Linear velocity of gas stream, ft/sec.
- P_s = Absolute pressure of gas stream, in. Hg ($P_{bar}+P_g$)
- A_n = Cross sectional area of nozzle, ft^2

8 Refinery Process Kettles

Particulate Concentration & Emission Rate

$$Cs, gr/dscf = (0.0154\ gr/mg)(m_n)/(V_{m\ std})$$

$$E, lb/hr = (Cs)(Qsd)/(7000\ gr/lb)$$

$$E, lb/hr/24\ hr = (E, lb/hr)(24)$$

Particulate Matter

Parameter	Run 1	Run 2	Run 3
m_n, mg	6.3	9.8	5.8
$V_{m\ std}$, dscf	39.612	39.891	39.994
C_s, gr/dscf	0.00245	0.00378	0.00223
Q_{sd}, dscf/hr	4,927,073	4,890,445	4,960,585
E, lb/hr	1.724	2.643	1.583
E, lb/24 hr	41.38	63.44	37.98

Lead (Pb)

Parameter	Run 1	Run 2	Run 3
m_n, mg	1.20	0.78	0.35
$V_{m\ std}$, dscf	39.612	39.891	39.994
C_s, gr/dscf	0.00047	0.00030	0.00013
Q_{sd}, dscf/hr	4,927,073	4,890,445	4,960,585
E, lb/hr	0.328	0.210	0.096
E, lb/24 hr	7.88	5.05	2.92

Nomenclature

m_n = pollutant material collected, mg or ug
$V_{m(std)}$ = Dry gas volume corrected to dry, standard conditions, ft^3
Cs, gr/dscf = pollutant concentration, grains per dry standard cubic ft.
Q_{sd} = Volumetric flow rate of gas stream, dry basis, std cond., ft^3/hr
E, lb/hr = pollutant mass emission rate, pounds per hour
E, lb/hr/24 hr = pollutant mass emission rate, lb/hr per 24 hour period

Calculations

The following section provides a detailed description of all calculations used in the determination of emission rates for . Also listed are all of the intermediate values associated with these calculations.

9 Refinery Bldg. Baghouse

Dry Gas Meter Volume

$$V_{m(std)} = Vm\left[\frac{T_{STD}}{T_m}\right]\left[\frac{P_{bar} + \dfrac{\Delta H}{13.6}}{P_{std}}\right] = 17.64[Y][V_m]\left[\frac{P_{bar} + \dfrac{\Delta H}{13.6}}{T_m}\right]$$

Parameter	Run 1	Run 2	Run 3
Vm	41.653	41.523	40.384
Tm	501	496	496
Pbar	30.2	30.2	30.2
ΔH avg	1.77	1.73	1.74
C Factor (Y)	1.036	1.036	1.036
Vm std	44.497	44.820	43.570

Nomenclature

ΔH = Average pressure drop across orifice, in. H_2O.
P_{bar} = Barometric pressure, in. Hg.
T_m = Absolute gas meter temperature, °R
V_m = Dry gas volume measured, ft^3
Y = Dry gas meter calibration factor
$V_{m(std)}$ = Dry gas volume corrected to dry, standard conditions, ft^3

Water Vapor Condensed

$$V_{wcstd} = \left[\frac{P_w \bullet R \bullet T_{std}}{M_w \bullet P_{std}}\right][V_f - V_i] = 0.04707[V_f - V_i]$$

$$V_{wsgstd} = \left[\frac{R \bullet T_{std}}{M_w \bullet P_{std}}\right][W_f - W_i] = 0.04715[W_f - W_i]$$

Moisture Content

$$B_{ws} = \left[\frac{V_{wcstd} + V_{wsgstd}}{V_{wcstd} + V_{wsgstd} + V_{mstd}}\right] \bullet 100$$

Parameter	Run 1	Run 2	Run 3
V_{wc}	0.141	0.188	0.188
V_{wsg}	0.189	0.141	0.141
Bws, %	0.74	0.73	0.75

Nomenclature:

B_{ws} = Water vapor, by volume, in gas stream, %
ΔH = Average pressure drop across orifice, in. H_2O.
P_{bar} = Barometric pressure, in. Hg.
T_m = Absolute gas meter temperature, °R
V_f, V_i = Impinger system volume, final & initial, ml
V_m = Dry gas volume measured, ft^3
$V_{m(std)}$ = Dry gas volume corrected to dry, standard conditions, ft^3
$V_{wc(std)}$ = Water vapor condensed, ml
$V_{wsg(std)}$ = Water vapor captured in silica gel, g
W_f, W_i = Silica gel weight, final & initial, g
Y = Dry gas meter calibration factor
0.04707 = Conversion factor, ft^3/ml
0.04715 = Conversion factor, ft^3/g

Dry Molecular Weight

$$M_d = 0.44[\%CO_2] + 0.32[\%O_2] + 0.28[\%CO+\%N_2]$$

Molecular Weight of Gas Stream

$$M_s = M_d \bullet \left[\frac{1-Bws}{100}\right] + 18 \bullet \left[\frac{Bws}{100}\right]$$

Parameter	Run 1	Run 2	Run 3
O2, %	20.9	20.9	20.9
CO2, %	0.0	0.0	0.0
CO + N2, %	79.1	79.1	79.1
Bws, %	0.74	0.73	0.75
Md, lb/lb-mole	28.84	28.84	28.84
Ms, lb/lb-mole	28.76	28.76	28.75

Nomenclature

B_{ws} = Water vapor, by volume, in gas stream, %
M_d = Dry molecular weight of gas stream, lb/lb-mole
M_s = Molecular weight of gas stream actual conditions, (lb/lb-mole)
$\%CO_2$ = Carbon dioxide concentration, by volume, %
$\%O_2$ = Oxygen concentration, by volume, %
$\%N_2$ = Nitrogen concentration, by volume, %
%CO = Carbon monoxide concentration, by volume, %
18 = Molecular weight of H_2O vapor, lb/lb-mole

Linear Velocity of Gas Stream

$$V_s = K_p C_p \left[\sqrt{\Delta P}\right]_{avg} \sqrt{\frac{T_s}{P_s M_s}}$$

Parameter	Run 1	Run 2	Run 3
Kp	85.49	85.49	85.49
Cp	0.84	0.84	0.84
SQRT (dP) avg	0.91	0.90	0.90
Ts, R	498	496	498
Ps	29.46	29.46	29.46
Vs	50.10	49.56	49.66

Volumetric Flow Rate of Gas Stream

$$Q_{sd} = 3600\left[1 - B_{ws}\right] V_s A \left[\frac{T_{std}}{T_s}\right]\left[\frac{P_s}{P_{std}}\right]$$

Parameter	Run 1	Run 2	Run 3
Bws, %	0.74	0.73	0.75
As, ft^2	78.67	78.67	78.67
Ts, R	498	496	498
Ps	29.46	29.46	29.46
Qsd, SCFH	14,693,663	14,590,924	14,581,830

Nomenclature

A = Cross sectional area of gas stream, ft^2
B_{ws} = Water vapor, by volume, in gas stream, %
C_p = Calibration factor of pitot tube device, dimensionless
ΔP = Pressure differential of gas stream, in H_2O
K_p = 85.49 ft/sec[(lb/lb-mole•in. Hg)/(°K•in. H_2O)]$^{1/2}$
M_s = Molecular weight of gas stream actual conditions, (lb/lb-mole)
P_{bar} = Barometric pressure, in. Hg
P_g = Static pressure of gas stream, in Hg
P_s = Absolute pressure of gas stream, in. Hg ($P_{bar}+P_g$)
P_{std} = Absolute standard pressure, 29.92 in. Hg
Q_{sd} = Volumetric flow rate of gas stream, dry basis, std cond., ft^3/hr
T_s = Absolute temperature of gas stream, ° R
T_{std} = Absolute standard temperature, 528° R
V_s = Linear velocity of gas stream, ft/sec.
3600 = Conversion factor, sec/hr.

Isokinetic Variation

$$I = 100 \bullet T_s \left[\frac{(0.002669)\left\{ V_{ic} + \left(\frac{Y_i \bullet V_m}{T_m} \right) \left(P_{bar} + \frac{\Delta H}{13.6} \right) \right\}}{60 \bullet \Theta \bullet V_s \bullet P_s \bullet A_n} \right]$$

Parameter	Run 1	Run 2	Run 3
Ts, R	498	496	498
Vic	7	7	7
Yi	1.036	1.036	1.036
Vm	41.653	41.523	40.384
Tm	501	496	496
Pbar	30.2	30.2	30.2
dH avg	1.77	1.73	1.74
sampling time, min.	60	60	60
An	0.00024	0.00024	0.00024
I	99.13	100.56	97.81

Nomenclature

I = Isokinetic variation, %
T_s = Absolute temperature of gas stream, ° R
V_{ic} = Water vapor condensed from gas stream, ml
Y = Dry gas meter calibration factor
V_m = Dry gas volume measured, ft^3
T_m = Absolute gas meter temperature, °R
P_{bar} = Barometric pressure, in. Hg.
ΔH = Average pressure drop across orifice, in. H_2O.
13.6 = Inches of water per Hg.
V_s = Linear velocity of gas stream, ft/sec.
P_s = Absolute pressure of gas stream, in. Hg ($P_{bar}+P_g$)
A_n = Cross sectional area of nozzle, ft^2

Pollutant Concentration & Emission Rate

$$Cs, gr/dscf = (0.0154\ gr/mg)(m_n)/(V_{m\ std})$$

$$E, lb/hr = (Cs)(Qsd)/(7000\ gr/lb)$$

$$E, lb/hr/24\ hr = (E, lb/hr)(24)$$

Particulate Matter

Parameter	Run 1	Run 2	Run 3
m_n, mg	7.000	8.300	5.700
$V_{m\ std}$, dscf	44.497	44.820	43.570
C_s, gr/dscf	0.0024	0.0029	0.0020
Q_{sd}, dscf/hr	14,693,663	14,590,924	14,581,830
E, lb/hr	5.09	5.94	4.20
E, lb/24 hr	122.05	142.67	100.72

Lead (Pb)

Parameter	Run 1	Run 2	Run 3
m_n, mg	4.3	0.98	0.67
$V_{m\ std}$, dscf	44.497	44.820	43.570
C_s, gr/dscf	0.00149	0.00034	0.00024
Q_{sd}, dscf/hr	14,693,663	14,590,924	14,581,830
E, lb/hr	3.12	0.70	0.49
E, lb/24 hr	74.97	16.85	11.84

Nomenclature

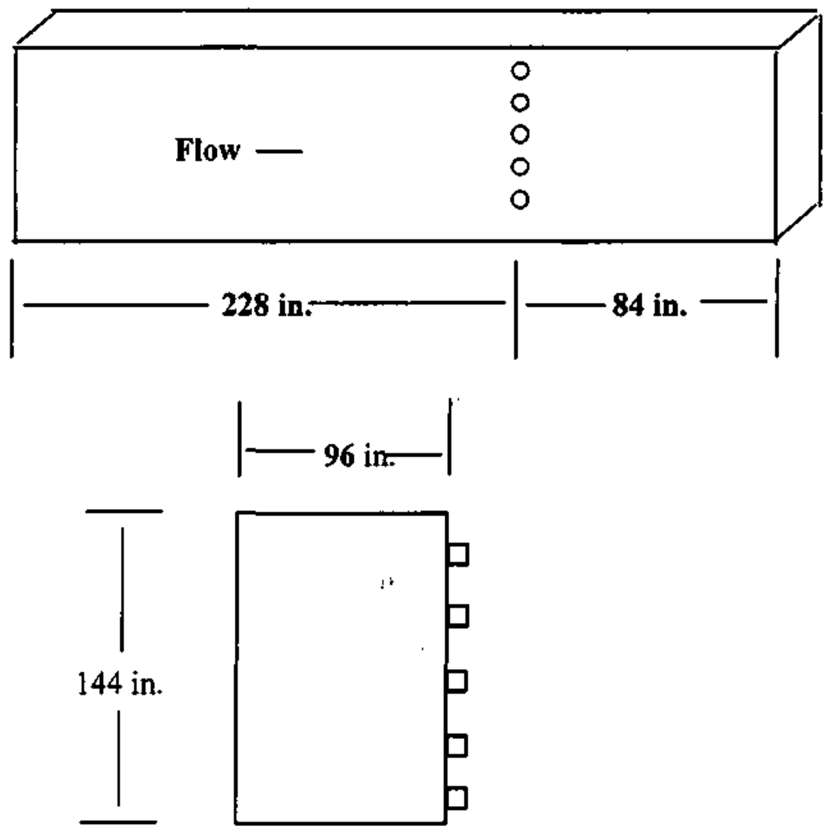
m_n = pollutant material collected, mg or ug
$V_{m(std)}$ = Dry gas volume corrected to dry, standard conditions, ft^3
Cs, gr/dscf = pollutant concentration, grains per dry standard cubic ft.
Q_{sd} = Volumetric flow rate of gas stream, dry basis, std cond., ft^3/hr
E, lb/hr = pollutant mass emission rate, pounds per hour
E, lb/hr/24 hr = pollutant mass emission rate, lb/hr per 24 hour period

Appendix A - Diagrams

Source Dimensions / Traverse Point Diagram

Sample Train Schematic(s)

7 Blast Furnace Bldg.



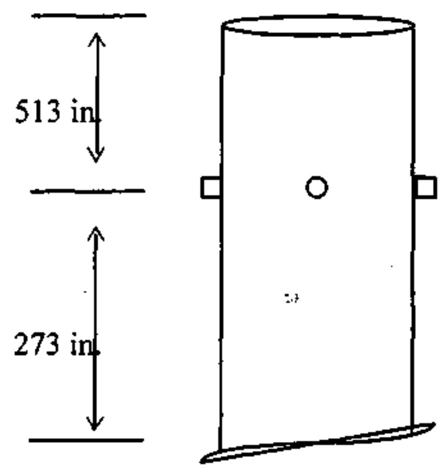
Equivalent Diameter: 115.2 in.
Stack area: 13,824 in^2 (96 ft^2)

	Upstream	Downstream
Distance, in.	84	228
Equiv. Dia.	0.7	2.0
Point	**% Diameter**	**Distance, in.**
1	12.5	12.0
2	29.2	28.0
3	45.8	44.0
4	62.5	60.0
5	79.2	76.0
6	95.8	92.0

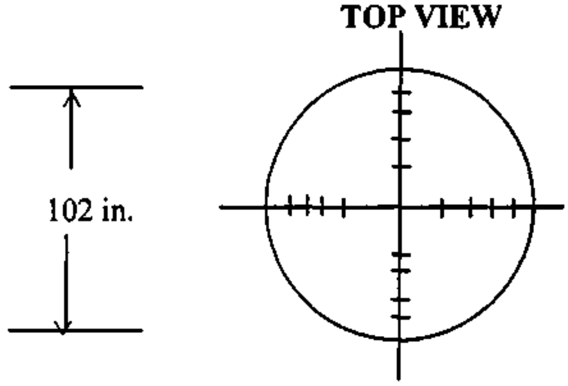
* Traverse point distance includes a 4 inch port stand-off.

8 Refinery Process Kettles

SIDE VIEW



TOP VIEW

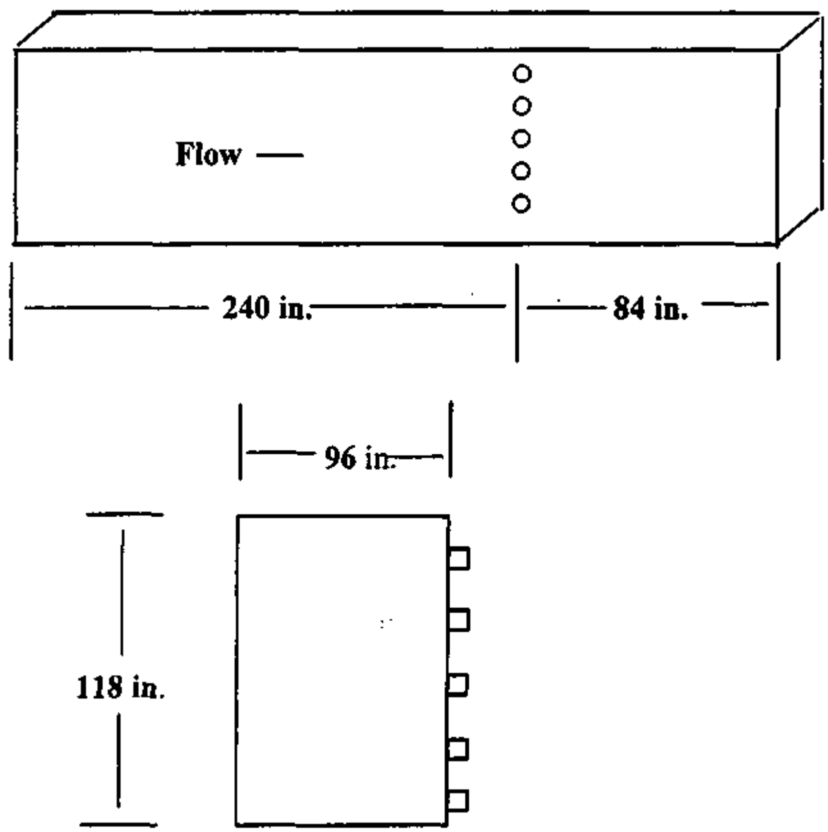


Stack area: 8,171 in^2 (56.74 ft^2)

	Upstream	Downstream
Distance, in.	513	273
Equiv. Dia.	5.0	2.7
Point	**% Diameter**	**Distance, in.**
1	3.2	7.3
2	10.5	14.7
3	19.4	23.8
4	32.3	36.9
5	67.7	73.1
6	80.6	86.2
7	89.5	95.3
8	96.8	102.7

* Traverse point distance includes a 4 inch port stand-off.

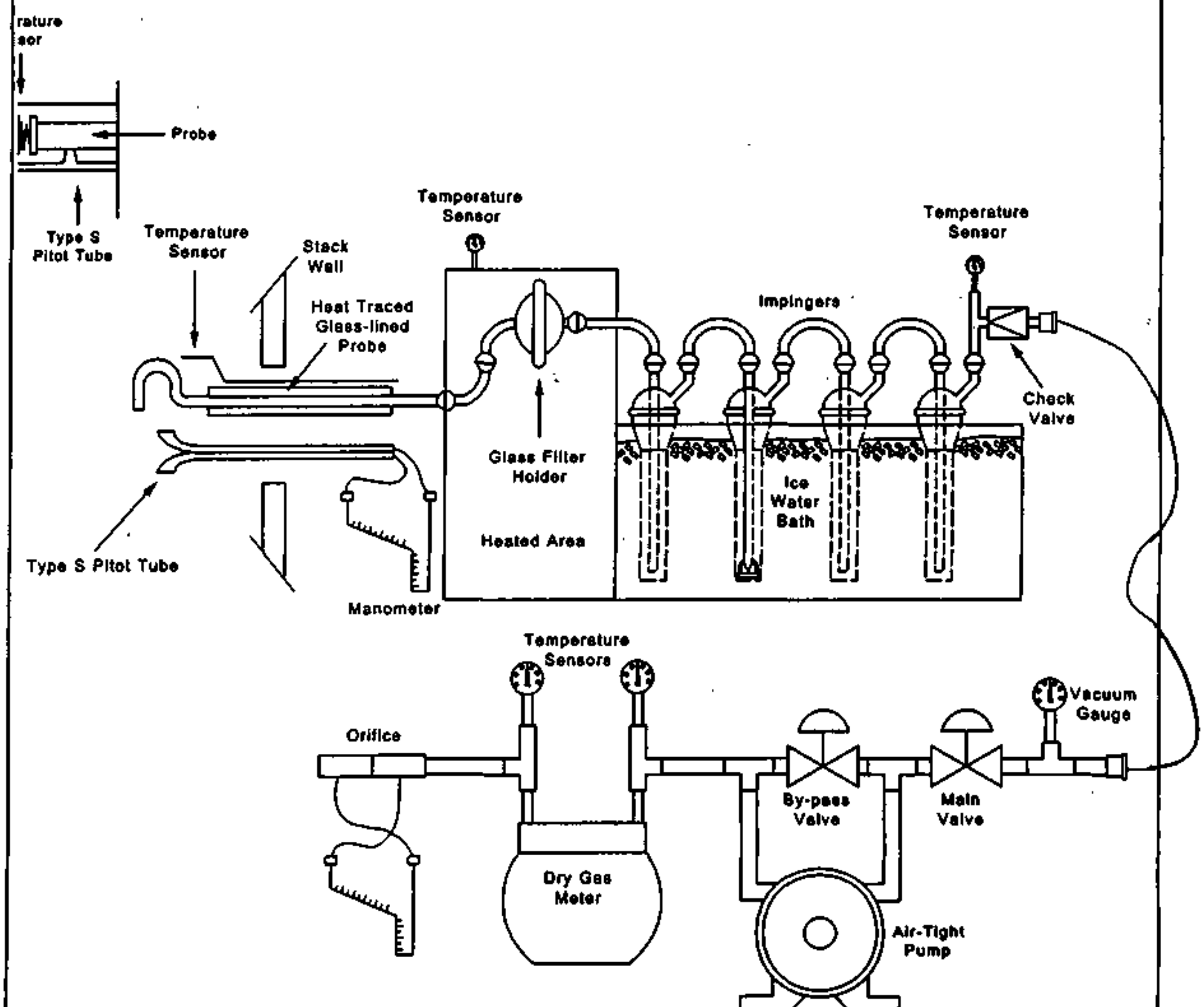
9 Refinery Bldg.



Equivalent Diameter: 105.9 in.
Stack area: 11,328 in^2 (78.67 ft^2)

	Upstream	Downstream
Distance, in.	84	240
Equiv. Dia.	0.8	2.3
Point	% Diameter	Distance, in.
1	12.5	12.0
2	29.2	28.0
3	45.8	44.0
4	62.5	60.0
5	79.2	76.0
6	95.8	92.0

* Traverse point distance includes a 4 inch port stand-off.


rature
sor
Probe
Type S
Pitot Tube
Temperature
Sensor
Stack
Wall
Heat Traced
Glass-lined
Probe
Temperature
Sensor
Glass Filter
Holder
Heated Area
Impingers
Ice
Water
Bath
Temperature
Sensor
Check
Valve
Type S Pitot Tube
Manometer
Temperature
Sensors
Orifice
Dry Gas
Meter
By-pass
Valve
Main
Valve
Vacuum
Gauge
Air-Tight
Pump

Appendix B - Analysis Results (PM/Pb)

Pb Analysis Reports

PM Analysis Reports

Chain of Custody Records

AMERICAN INTERPLEX CORPORATION LABORATORIES

8600 Kanis Road
Little Rock, AR 72204-2322
(501) 224-5060
FAX (501) 224-5072

R E P O R T

White Star Environmental Consulting
ATTN: Mr. Joe Sewell
7886 Kirkwood Cove
Olive Branch, MS 38654

January 7, 2003
Control No. 70556

Project Description: Four (4) filter and eight (8) impinger sample(s) received on December 31, 2002
Doe Run Company-Herculaneum Facility
#7 Baghouse
12/3/2002

Dear Mr. Joe Sewell:

Please find enclosed analytical results for the sample(s) submitted to American Interplex Corporation (AIC) on December 31, 2002. The following results are applicable only to samples identified by the control number designated above. Accurate assessment of the data requires access to the entire document. Each section of the report has been reviewed and approved by the appropriate laboratory director or a qualified designee.

If you have any questions, please reference Control No. 70556.

AMERICAN INTERPLEX CORPORATION

By

John Overbey
Laboratory Director

KH/lims

Enclosure(s): Analysis Protocol Form

AMERICAN INTERPLEX CORPORATION LABORATORIES

8600 Kanis Road
Little Rock, AR 72204-2322
(501) 224-5060
FAX (501) 224-5072

REPORT

White Star Environmental Consulting
7886 Kirkwood Cove
Olive Branch, MS 38654

ATTN: Mr. Joe Sewell

Project Description: Four (4) filter and eight (8) impinger sample(s) received on December 31, 2002
Doe Run Company-Herculaneum Facility
#7 Baghouse
12/3/2002

Sample Identification: #1927 Run #1, Impinger Catch, Impinger Wash 12/3/02
AIC No. 70556-1

Parameter	Method	Result	Batch	Time Analyzed	By
Lead	EPA 12	0.22 mg	S9675	02JAN03 0933	201/65

Sample Identification: #1943 Run #2, Impinger Catch, Impinger Wash 12/3/02
AIC No. 70556-2

Parameter	Method	Result	Batch	Time Analyzed	By
Lead	EPA 12	0.77 mg	S9675	02JAN03 0933	201/65

Sample Identification: #1942 Run #3, Impinger Catch, Impinger Wash 12/3/02
AIC No. 70556-3

Parameter	Method	Result	Batch	Time Analyzed	By
Lead	EPA 12	0.70 mg	S9675	02JAN03 0933	201/65

Sample Identification: Blank
AIC No. 70556-4

Parameter	Method	Result	Batch	Time Analyzed	By
Lead	EPA 12	<0.004 mg	S9675	02JAN03 0933	201/65

AMERICAN INTERPLEX CORPORATION LABORATORIES

8600 Kanis Road
Little Rock, AR 72204-2322
(501) 224-5060
FAX (501) 224-5072

QC REPORT

White Star Environmental Consulting
7886 Kirkwood Cove
Olive Branch, MS 38654

January 7, 2003
Control No. 70556

Parameter	% Recovery	Relative % Difference	Batch
Lead	83.6	1.90	S9675

Data has been validated using standard quality control measures (blank, laboratory control, spike and spike duplicate) performed on at least 10% of samples analyzed. Quality Assurance, instrumentation maintenance and calibration were performed in accordance with guidelines established by the USEPA.
SM method = Standard Methods for the Examination of Water and Wastewaster, 20th edition, 1998.

KH/lims

70556

White Star
ENVIRONMENTAL CONSULTING

ANALYSIS PROTOCOL

Facility: Doe Run Company – Herculaneum Facility
Source ID: # 7 Baghouse
Test Date: 12/3/ 2002

	Sample ID	Sample Type	Analysis Req'	Method	A1C
1	Run #1	Filter # 1927	Lead	12	1
3	Run #2	Filter # 1943	Lead	12	2
5	Run #3	Filter # 1942	Lead	12	3
2	Run #1	Imp Catch	Lead	12	1
4	Run #2	Imp Catch	Lead	12	2
6	Run #3	Imp Catch	Lead	12	3
2	Run #1	HNO_3 Rinse	Lead	12	1
4	Run #2	HNO_3 Rinse	Lead	12	2
6	Run #3	HNO_3 Rinse	Lead	12	3
7	Blank	HNO_3 Rinse	Lead	12	4
8	Blank	Filter	Lead	12	4

KW 12/3/02

Composite "Imp Catch" samples with "HNO_3 Rinse" samples by run number.
Report results in mg or ug.

Please fax results upon completion to Joe Sewell at (662) 895-1651.

AMERICAN INTERPLEX
CORPORATION
LABORATORIES

8600 Kanis Road
Little Rock, AR 72204-2322
(501) 224-5060
FAX (501) 224-5072

REPORT

White Star Environmental Consulting
ATTN: Mr. Joe Sewell
7886 Kirkwood Cove
Olive Branch, MS 38654

January 7, 2003
Control No. 70559

Project Description: Three (3) filter and six (6) impinger sample(s) received on December 31, 2002
Doe Run Company-Herculaneum Facility
#8 Baghouse
12/5/2002

Dear Mr. Joe Sewell:

Please find enclosed analytical results for the sample(s) submitted to American Interplex Corporation (AIC) on December 31, 2002. The following results are applicable only to samples identified by the control number designated above. Accurate assessment of the data requires access to the entire document. Each section of the report has been reviewed and approved by the appropriate laboratory director or a qualified designee.

If you have any questions, please reference Control No. 70559.

AMERICAN INTERPLEX CORPORATION

By ______________________
John Overbey
Laboratory Director

KH/lims

Enclosure(s): Analysis Protocol Form

AMERICAN INTERPLEX CORPORATION
LABORATORIES

REPORT

8600 Kanis Road
Little Rock, AR 72204-2322
(501) 224-5060
FAX (501) 224-5072

White Star Environmental Consulting
7886 Kirkwood Cove
Olive Branch, MS 38654

January 7, 2003
Control No. 70559

ATTN: Mr. Joe Sewell

Project Description: Three (3) filter and six (6) impinger sample(s) received on December 31, 2002
Doe Run Company-Herculaneum Facility
#8 Baghouse
12/5/2002

Sample Identification: 3003 Run #1 Impinger Catch, Impinger Wash 12/5/02
AIC No. 70559-1

Parameter	Method	Result	Batch	Time Analyzed By
Lead	EPA 12	1.2 mg	S9675	02JAN03 0933 201/65

Sample Identification: 3000 Run #2 Impinger Catch, Impinger Wash 12/5/02
AIC No. 70559-2

Parameter	Method	Result	Batch	Time Analyzed By
Lead	EPA 12	0.78 mg	S9675	02JAN03 0933 201/65

Sample Identification: 3002 Run #3 Impinger Catch, Impinger Wash 12/5/02
AIC No. 70559-3

Parameter	Method	Result	Batch	Time Analyzed By
Lead	EPA 12	0.35 mg	S9675	02JAN03 0933 201/65

AMERICAN INTERPLEX CORPORATION
LABORATORIES

QC REPORT

8600 Kanis Road
Little Rock, AR 72204-2322
(501) 224-5060
FAX (501) 224-5072

White Star Environmental Consulting
7886 Kirkwood Cove
Olive Branch, MS 38654

January 7, 2003
Control No. 70559

Parameter	% Recovery	Relative % Difference	Batch
Lead	83.6	1.90	S9675

Data has been validated using standard quality control measures (blank, laboratory control, spike and spike duplicate) performed on at least 10% of samples analyzed. Quality Assurance, instrumentation maintenance and calibration were performed in accordance with guidelines established by the USEPA.
SM method = Standard Methods for the Examination of Water and Wastewaster, 20th edition, 1998.

KH/lims

70559

White Star
ENVIRONMENTAL CONSULTING

ANALYSIS PROTOCOL

Facility: Doe Run Company – Herculaneum Facility
Source ID: # 8 Baghouse
Test Date: 12/5/ 2002

	Sample ID	Sample Type	Analysis Req'	Method	A/C
1	Run #1	Filter # 3003	Lead	12	1
3	Run #2	Filter # 3000	Lead	12	2
5	Run #3	Filter # 3002	Lead	12	3
2	Run #1	Imp Catch	Lead	12	1
4	Run #2	Imp Catch	Lead	12	2
6	Run #3	Imp Catch	Lead	12	3
2	Run #1	HNO_3 Rinse	Lead	12	1
4	Run #2	HNO_3 Rinse	Lead	12	2
6	Run #3	HNO_3 Rinse	Lead	12	3
	~~Blank~~	~~HNO_3 Rinse~~	~~Lead~~	~~12~~	
	~~Blank~~	~~Filter~~	~~Lead~~	~~12~~	

12/3/02

Composite "Imp Catch" samples with "HNO_3 Rinse" samples by run number.
Report results in mg or ug.

Please fax results upon completion to Joe Sewell at (662) 895-1651.

AMERICAN INTERPLEX CORPORATION
LABORATORIES

8600 Kanis Road
Little Rock, AR 72204-2322
(501) 224-5060
FAX (501) 224-5072

REPORT

White Star Environmental Consulting
ATTN: Mr. Joe Sewell
7886 Kirkwood Cove
Olive Branch, MS 38654

January 7, 2003
Control No. 70561

Project Description: Three (3) filter and six (6) impinger sample(s) received on December 31, 2002
Doe Run Company-Herculaneum Facility
#9 Baghouse
12/4/2002

Dear Mr. Joe Sewell:

Please find enclosed analytical results for the sample(s) submitted to American Interplex Corporation (AIC) on December 31, 2002. The following results are applicable only to samples identified by the control number designated above. Accurate assessment of the data requires access to the entire document. Each section of the report has been reviewed and approved by the appropriate laboratory director or a qualified designee.

If you have any questions, please reference Control No. 70561.

AMERICAN INTERPLEX CORPORATION

By ____________________
John Overbey
Laboratory Director

KH/lims

Enclosure(s): Analysis Protocol Form

AMERICAN INTERPLEX CORPORATION LABORATORIES

8600 Kanis Road
Little Rock, AR 72204-2322
(501) 224-5060
FAX (501) 224-5072

REPORT

White Star Environmental Consulting
7886 Kirkwood Cove
Olive Branch, MS 38654

January 7, 2003
Control No. 70561

ATTN: Mr. Joe Sewell

Project Description: Three (3) filter and six (6) impinger sample(s) received on December 31, 2002
Doe Run Company-Herculaneum Facility
#9 Baghouse
12/4/2002

Sample Identification: #1931 Run #1 Impinger Catch, Impinger Wash 12/4/02
AIC No. 70561-1

Parameter	Method	Result	Batch	Time Analyzed By
Lead	EPA 12	4.3 mg	S9675	02JAN03 0933 201/65

Sample Identification: #2003 Run #2 Impinger Catch, Impinger Rinse 12/4/02
AIC No. 70561-2

Parameter	Method	Result	Batch	Time Analyzed By
Lead	EPA 12	0.98 mg	S9675	02JAN03 0933 201/65

Sample Identification: #2004 Run #3 Impinger Catch, Impinger Wash 12/4/02
AIC No. 70561-3

Parameter	Method	Result	Batch	Time Analyzed By
Lead	EPA 12	0.67 mg	S9675	02JAN03 0933 201/65

AMERICAN INTERPLEX CORPORATION
LABORATORIES

8600 Kanis Road
Little Rock, AR 72204-2322
(501) 224-5060
FAX (501) 224-5072

QC REPORT

White Star Environmental Consulting
7886 Kirkwood Cove
Olive Branch, MS 38654

January 7, 2003
Control No. 70561

Parameter	% Recovery	Relative % Difference	Batch
Lead	83.6	1.90	S9675

Data has been validated using standard quality control measures (blank, laboratory control, spike and spike duplicate) performed on at least 10% of samples analyzed. Quality Assurance, instrumentation maintenance and calibration were performed in accordance with guidelines established by the USEPA.
SM method = Standard Methods for the Examination of Water and Wastewaster, 20th edition, 1998.

KH/lims

70561

White Star
ENVIRONMENTAL CONSULTING

ANALYSIS PROTOCOL

Facility: Doe Run Company – Herculaneum Facility
Source ID: # 9 Baghouse
Test Date: 12/4/2002

Kw 12/3/02

	Sample ID	Sample Type	Analysis Req'	Method	AIC No
	Run #1	Filter # 1931	Lead	12	1
3	Run #2	Filter # 2003	Lead	12	2
5	Run #3	Filter # 2004	Lead	12	3
2	Run #1	Imp Catch	Lead	12	1
4	Run #2	Imp Catch	Lead	12	2
6	Run #3	Imp Catch	Lead	12	3
2	Run #1	HNO_3 Rinse	Lead	12	1
4	Run #2	HNO_3 Rinse	Lead	12	2
6	Run #3	HNO_3 Rinse	Lead	12	3
	~~Blank~~	~~HNO_3 Rinse~~	~~Lead~~	~~12~~	
	~~Blank~~	~~Filter~~	~~Lead~~	~~12~~	

Composite "Imp Catch" samples with "HNO_3 Rinse" samples by run number.
Report results in mg or ug.

Please fax results upon completion to Joe Sewell at (662) 895-1651.

Memphis, TN - Houston, TX

Main Office: P.O. Box 238; Olive Branch, MS 38654; (601) 893-3063; Fax: (601) 895-1651

Gravimetric Analysis Report

Doe Run Company
Herculaneum, MO
#9 Baghouse

Acetone Blank Sample			
	Volume, ml	40	Date/Time
	1st weight	35.1089	12/15; 8:00
	2nd weight	35.1089	12/26; 10:00
	Average	35.1089	
	Tare Wt.	35.1087	
	Blank Wt.	0.0002	
Filter Samples			
Item	**Run 1**	**Run 2**	**Run 3**
Filter No.	1931	2003	2004
1st weight	1.1389	1.243	1.2392
2nd weight	1.1389	1.2433	1.2394
Average	1.1389	1.24315	1.2393
Tare Wt.	1.1342	1.2418	1.2369
Wt. of PM	0.0047	0.00135	0.0024
Acetone Wash Samples			
Item	**Run 1**	**Run 2**	**Run 3**
Volume, ml	50	60	65
1st weight	35.3606	33.4327	35.7543
2nd weight	35.3608	33.433	35.7543
Average	35.3607	33.43285	35.7543
Tare Wt.	35.3581	33.4256	35.7507
Blank Wt.	0.0002	0.0003	0.0003
Wt. of PM	0.0023	0.0069	0.0033
Particulate Matter, mg			
Filter Wt.	4.7	1.3	2.4
Acetone Wt.	2.3	6.9	3.3
Total Wt.	**7.0**	**8.3**	**5.7**

Analyst: WB

Hygrometer: 40 %

White Star Environmental

Gravimetric Analysis Report

Doe Run Company
Herculaneum, MO
#8 Baghouse

Acetone Blank Sample			
	Volume, ml	40	Date/Time
	1st weight	35.1089	12/15; 8:00
	2nd weight	35.1089	12/26; 10:00
	Average	35.1089	
	Tare Wt.	35.1087	
	Blank Wt.	0.0002	
Filter Samples			
Item	**Run 1**	**Run 2**	**Run 3**
Filter No.	3003	3000	3002
1st weight	1.1639	1.2475	1.2217
2nd weight	1.1639	1.2477	1.2217
Average	1.1639	1.2476	1.2217
Tare Wt.	1.1607	1.2425	1.2201
Wt. of PM	0.0032	0.0051	0.0016
Acetone Wash Samples			
Item	**Run 1**	**Run 2**	**Run 3**
Volume, ml	40	55	55
1st weight	49.4396	36.1486	35.2781
2nd weight	49.4398	36.1487	35.2782
Average	49.4397	36.14865	35.2782
Tare Wt.	49.4364	36.1437	35.2737
Blank Wt.	0.0002	0.0003	0.0003
Wt. of PM	0.0031	0.0047	0.0042
Particulate Matter, mg			
Filter Wt.	3.2	5.1	1.6
Acetone Wt.	3.1	4.7	4.2
Total Wt.	**6.3**	**9.8**	**5.8**

Analyst: wg

Hygrometer: 40 %

Gravimetric Analysis Report

Doe Run Company
Herculaneum, MO
#7 Baghouse

Acetone Blank Sample			
Volume, ml		40	**Date/Time**
1st weight		35.1089	12/15; 8:00
2nd weight		35.1089	12/26; 10:00
Average		35.1089	
Tare Wt.		35.1087	
Blank Wt.		0.0002	
Filter Samples			
Item	**Run 1**	**Run 2**	**Run 3**
Filter No.	1927	1943	1942
1st weight	1.2769	1.3446	1.3176
2nd weight	1.2769	1.3447	1.3178
Average	1.2769	1.34465	1.3177
Tare Wt.	1.275	1.3363	1.3109
Wt. of PM	0.0019	0.00835	0.0068
Acetone Wash Samples			
Item	**Run 1**	**Run 2**	**Run 3**
Volume, ml	70	60	55
1st weight	53.0244	52.6489	49.1823
2nd weight	53.0244	52.6491	49.1826
Average	53.0244	52.649	49.1825
Tare Wt.	53.0176	52.6446	49.1788
Blank Wt.	0.0003	0.0003	0.0003
Wt. of PM	0.0064	0.0041	0.0034
Particulate Matter, mg			
Filter Wt.	1.9	8.4	6.8
Acetone Wt.	6.4	4.1	3.4
Total Wt.	**8.3**	**12.5**	**10.2**

Analyst: wb

Hygrometer: 40 **%**

Appendix C - Field Data Records

Facility Doe Run
Location Herculaneum, MO
Operator TC
Date 12/3/02
Run No. 1
Sample Box No. APEX
Meter Box No. APEX
Meter Δ H@ 1.9
C Factor 1.0
Pitot Coeff (C_p) 0.84

#7 Baghouse

Diameter (in.)
Downstream (in.)
Upstream (in.)

Ambient Temp 33
Barometric Pressure 29.8 (29.26)
Diameter 0.21
Leak Rate (cfm) 0.002 15" Hg
Static Pressure -10.0" H_2O
Filter No. 1927
Impinger Vol. (initial) 200
Impinger Vol. (final) 206
Silica Gel Wt. (initial) 400
Silica Gel Wt. (final) 410

6 pts/port
2 min/point

Initial Meter Reading: ~~180~~ 139.554

Traverse Point No.	Sample Time (min.)	Sample Vacuum (in. Hg)	Stack Temp. (°F)	ΔP in. H_2O	ΔH in. H_2O	Gas Volume (ft³)	DGM Temp. IN	DGM Temp. OUT	Filter Temp. (°F)	Last Impinger (°F)
1	1032/2	6	34	.65	1.4	140.7	36	36		32
2	1034	6	34	.65	1.4	141.9	37	36		33
3	1036	6	37	.75	1.6	143.2	40	36		36
4	1038	6	38	.75	1.6	144.7	42	36		40
5	1040	6	45	.75	1.6	146.0	44	36		42
6	1042	6	47	.70	1.5	147.2	45	37		43
7	~~1044~~ 6	5	41	.60	1.7	148.4	41	37		40
8	1048	6	40	.75	1.6	149.6	44	37		42
9	1050	7	38	.80	1.7	151.0	46	37		43
10	1052	7	41	.90	1.9	152.4	47	37		44
11	1054	7	44	.90	1.9	154.0	49	38		45
12	1056	6	47	.75	1.6	155.3	49	38		45
13	~~1058~~ 1100	7	40	1.0	2.1	156.8	43	38		41
14	1102	6	39	.80	1.7	158.2	47	38		43
15	1104	6	40	.90	1.9	159.6	48	38		43
16	1106	6	41	.85	1.8	161.0	50	39		44
17	1108	6	43	.85	1.8	162.4	50	39		43
18	1110	6	45	.85	1.8	163.8	51	39		43
19	~~1112~~ 1114	8	40	1.3	2.7	165.6	45	39		46
20	1116	8	40	1.3	2.7	167.2	49	39		43
21	1118	8	42	1.2	2.6	169.0	51	39		43
22	1120	8	43	1.1	2.3	170.6	51	40		43
23	1122	8	45	1.1	2.3	172.2	52	40		43
24	1124	7	47	1.0	2.1	173.7	52	40		42
25	~~1126~~ 1128	6	40	.75	1.6	175.0	44	40		40
26	1130	6	38	.80	1.7	176.3	48	40		41
27	1132	6	39	.80	1.7	177.8	49	40		41
28	1134	6	40	.85	1.8	179.2	51	40		41
29	1136	6	42	.90	1.9	180.6	51	40		41
30	1138	6	42	.85	1.8	182.0	51	40		41

Final Meter Reading: 182.060

Facility Doe Run
Location Herculaneum, MO
Operator TL
Date 12/3/02
Run No. 2
Sample Box No. Apex
Meter Box No. Apex
Meter Δ H_a 1.9
C Factor 1.0
Pitot Coeff (C_p) 0.84

#7 Bypass

Diameter (in.)
Downstream (in.)
Upstream (in.)

Ambient Temp 35
Barometric Pressure 29.8
Diameter 0.21
Leak Rate (cfm) 0.0 @ 15"
Static Pressure ~~-1.0~~ -8.0 " H_2O
Filter No. 1943
Impinger Vol. (initial) 200
Impinger Vol. (final) 204
Silica Gel Wt. (initial) 410
Silica Gel Wt. (final) 416

Initial Meter Reading: 182.209

Traverse Point No.	Sample Time (min.)	Sample Vacuum (in. Hg)	Stack Temp. (°F)	ΔP in. H_2O	ΔH in. H_2O	Gas Volume (ft^3)	DGM Temp. IN	DGM Temp. OUT	Filter Temp. (°F)	Last Impinger (°F)
1	1222/24	9	40	1.3	2.7	184.0	37	37		36
2	1226	7	40	1.1	2.3	185.5	37	37		38
3	1228	8	41	1.1	2.3	187.2	39	37		41
4	1230	8	41	1.1	2.3	188.9	41	37		41
5	1232	9	45	1.3	2.7	190.6	42	37		42
6	1234	9	48	1.1	2.3	192.1	43	37		42
7	~~1236~~ 38	8	43	1.0	2.1	193.7	41	37		40
8	1240	8	43	1.0	2.1	195.2	44	37		42
9	1242	9	44	1.1	2.3	196.8	45	37		42
10	1244	9	44	1.1	2.3	198.0	47	38		42
11	1246	9	45	1.1	2.3	200.1	48	38		42
12	1248	9	47	1.1	2.3	201.7	49	38		42
13	1250/52	8	41	.80	1.9	203.0	43	38		41
14	1254	8	41	.70	1.5	204.5	46	39		41
15	1256	8	41	.70	1.5	205.6	47	39		41
16	1258	9	43	.85	1.8	207.2	48	39		41
17	1300	9	44	.85	1.8	208.7	49	39		41
18	1302	9	48	.85	1.8	210.5	50	39		41
19	~~1304~~ 306	6	44	.65	1.4	211.8	43	39		39
20	1308	6	44	.65	1.4	213.0	46	39		41
21	1310	6	46	.70	1.5	214.3	50	40		41
22	1312	7	41	.70	1.5	215.7	49	39		42
23	1314	6	46	.75	1.6	216.0	49	40		42
24	1316	6	46	.75	1.6	217.5	49	40		42
25	~~1318~~ 1320	7	40	.50	1.1	218.7	43	39		40
26	1322	7	41	.70	1.5	220.0	47	40		41
27	1324	7	41	.65	1.4	221.2	49	40		41
28	1326	7	43	.70	1.5	222.4	50	40		42
29	1328	6	41	.75	1.6	223.7	51	40		42
30	1330	7	42	.75	1.6	225.0	51	40		42

Final Meter Reading: 225.089

Facility Doe Run
Location Herculaneum, MO
Operator TC
Date 12/3/02
Run No. 3
Sample Box No. APEX
Meter Box No. APEX
Meter Δ $H_@$ 1.9
C Factor 1.0
Pitot Coeff (C_p) 0.84

#7 Baghouse

Diameter (in.)
Downstream (in.)
Upstream (in.)

Ambient Temp 35
Barometric Pressure 29.8
Diameter 0.31
Leak Rate (cfm) 0.0 @ 15" Hg
Static Pressure -1.0" H_2O
Filter No. 1942
Impinger Vol. (initial) 200
Impinger Vol. (final) 205
Silica Gel Wt. (initial) 416
Silica Gel Wt. (final) ~~[illegible]~~ 420

Initial Meter Reading: 225.782

Traverse Point No.	Sample Time (min.)	Sample Vacuum (in. Hg)	Stack Temp. (°F)	ΔP in. H_2O	ΔH in. H_2O	Gas Volume (ft^3)	DGM Temp. IN	DGM Temp. OUT	Filter Temp. (°F)	Last Impinger (°F)
1	1446/48	7	38	.75	1.6	227.0	36	35		35
2	1450	8	38	1.0	2.1	228.8	37	35		36
3	1452	9	40	1.2	2.6	230.3	40	35		38
4	1454	9	42	1.2	2.6	232.0	42	35		38
5	1456	9	44	1.2	2.6	233.6	42	35		39
6	1458	10	49	1.2	2.6	235.2	43	36		39
7	1500/1502	8	41	1.0	2.1	236.9	39	36		37
8	1504	8	42	1.0	2.1	238.4	43	36		38
9	1506	9	42	1.2	2.6	240.0	43	36		38
10	1508	9	44	1.2	2.6	241.8	47	36		39
11	1510	8	46	1.1	2.3	243.4	48	37		38
12	1512	8	48	1.1	2.3	245.0	48	37		38
13	1514/16	6	41	.80	1.7	246.4	42	37		37
14	1518	6	38	.80	1.7	247.8	45	37		37
15	1520	6	38	.75	1.6	249.2	47	38		37
16	1522	6	40	.85	1.8	250.6	48	38		37
17	1524	6	43	.85	1.8	251.9	49	38	37	
18	1526	6	48	.85	1.8	253.3	49	38	37	
19	1528/30	5	40	.60	1.3	254.5	42	38	36	
20	1532	5	39	.60	1.3	255.8	46	38	36	
21	1534	5	38	.65	1.4	257.1	47	38	37	
22	1536	6	41	.85	1.8	258.5	45	38	37	
23	1538	6	45	.85	1.8	259.8	49	38	37	
24	1540	6	48	.85	1.8	261.1	49	38	37	
25	1542/44	7	41	1.0	2.1	262.7	43	38	36	
26	1546	6	37	.75	1.6	264.1	47	38	37	
27	1548	5	37	.65	1.4	265.2	43	39	36	
28	1550	5	38	.65	1.4	266.5	45	39	37	
29	1552	5	43	.75	1.6	267.8	49	39	36	
30	1554	5	47	.75	1.6	269.1	49	39	36	

Final Meter Reading: 269.138

3

Facility Doe Run
Location Herculaneum, MO
Operator JC
Date 12/5/02
Run No. 1
Sample Box No. APEX
Meter Box No. APEX
Meter ΔH_a 1.9
C Factor 1.0
Pitot Coeff (C_p) 0.84

#8 Baghouse

Diameter (in.)
Downstream (in.)
Upstream (in.)

Ambient Temp 35
Barometric Pressure 30.1
Diameter 0.29
Leak Rate (cfm) 0.0 @ 10" Hg
Static Pressure +0.2" H_2O
Filter No. 3003
Impinger Vol. (initial) 200
Impinger Vol. (final) 201
Silica Gel Wt. (initial) 494
Silica Gel Wt. (final) 487

Initial Meter Reading: 396.248

Traverse Point No.	Sample Time (min.)	Sample Vacuum (in. Hg)	Stack Temp. (°F)	ΔP in. H_2O	ΔH in. H_2O	Gas Volume (ft^3)	DGM Temp. IN	DGM Temp. OUT	Filter Temp. (°F)	Last Impinger (°F)
1	1015/[illegible].5	4	51	.19	1.5	397.8	37	35		42
2	1020	4	53	.17	1.3	399.2	38	35		43
3	1022.5	3	54	.15	1.2	400.6	41	35		44
4	1025	3	51	.15	1.2	402.3	43	36		43
5	1027.5	3	57	.15	1.2	403.7	45	36		43
6	1030	3	51	.13	1.0	404.9	46	37		42
7	1032.5	3	52	.13	1.0	406.2	47	37		41
8	1035	3	54	.13	1.0	406.5	48	37		41
9	1037.5	3	56	.13	1.0	408.0	48	38		40
10	1040	3	52	.15	1.2	410.3	50	38		39
11	1042.5	5	57	.21	1.6	412.0	51	39		40
12	1045	5	57	.21	1.6	413.7	52	39		40
13	~~[illegible]~~ 1047.5/1050	4	52	.19	1.5	415.4	45	39		38
14	1052.5	5	50	.21	1.6	417.0	50	39		38
15	1055	4	50	.17	1.3	418.4	51	39		39
16	1057.5	3	50	.15	1.2	420.0	51	39		38
17	1100	3	51	.13	1.0	421.2	51	40		38
18	1102.5	3	51	.13	1.0	422.6	51	40		37
19	1105	4	53	.15	1.2	424.0	51	40		37
20	1107.5	4	56	.19	1.5	425.2	51	40		37
21	1110	5	54	.25	1.9	427.7	51	40		37
22	1112.5	4	53	.33	2.5	429.6	51	40		37
23	1115	4	52	.25	1.9	431.3	51	40		37
24	1117.5	5	50	.35	2.7	433.6	51	40		37

Final Meter Reading: 433.652

Facility Doe Run
Location Herculaneum, MO
Operator TC
Date 12/5/02
Run No. 2
Sample Box No. APEX
Meter Box No. APEX
Meter Δ H_a 1.9
C Factor 1.0
Pitot Coeff (C_p) 0.84

#8 Baghouse

Diameter (in.)
Downstream (in.)
Upstream (in.)

Ambient Temp 35
Barometric Pressure 30.1
Diameter 0.39
Leak Rate (cfm)
Static Pressure +0.24 in H_2O
Filter No. 3000
Impinger Vol. (initial) 200
Impinger Vol. (final) 201
Silica Gel Wt. (initial) 487
Silica Gel Wt. (final) 491

Initial Meter Reading: 433.928

Traverse Point No.	Sample Time (min.)	Sample Vacuum (in. Hg)	Stack Temp. (°F)	ΔP in. H_2O	ΔH in. H_2O	Gas Volume (ft^3)	DGM Temp. IN	DGM Temp. OUT	Filter Temp. (°F)	Last Impinger (°F)
1	1150/26.	4	48	.13	1.0	435.2	37	37		38
2	1155	4	51	.15	1.2	436.7	39	37		39
3	1157.5	4	53	.13	1.0	438.1	42	37		40
4	1200	4	53	.13	1.0	439.4	44	37		41
5	1202.5	4	54	.15	1.2	441.0	45	37		41
6	1205	4	55	.15	1.2	442.3	47	37		41
7	1207.5	4	56	.15	1.2	443.9	48	38		41
8	1210	5	57	.23	1.8	445.6	49	38		41
9	1212.5	6	58	.27	2.1	447.6	51	38		41
10	1215	6	60	.25	1.9	449.5	51	38		40
11	1217.5	6	62	.31	2.4	451.4	52	39		39
12	1220	6	60	.35	2.9	453.6	52	39		39
13	1231/3.5	4	62	.17	1.3	455.0	44	38		40
14	1226	4	62	.17	1.3	456.6	50	40		40
15	1228.5	4	59	.15	1.2	458.4	51	40		[illegible]
16	1231	4	57	.15	1.2	459.8	51	40		41
17	1233.5	4	57	.15	1.2	461.0	52	40		42
18	1236	4	57	.15	1.2	462.3	52	40		42
19	1238.5	4	57	.13	1.0	463.4	52	40		43
20	1241	4	57	.13	1.0	465.1	52	41		43
21	1243.5	4	57	.19	1.5	466.7	52	41		43
22	1246	4	57	.19	1.5	468.4	52	41		44
23	1248.5	4	57	.19	1.5	470.1	52	41		44
24	1251	4	57	.19	1.5	471.6	52	41		44

Final Meter Reading: 471.651

Facility Doe Run
Location Herculaneum, MO
Operator TC
Date 12/5/02
Run No. 3
Sample Box No. APEX
Meter Box No. APEX
Meter Δ H@ 1.9
C Factor 1.0
Pitot Coeff (C_p) 0.84

#8 Baghouse

Diameter (in.)
Downstream (in.)
Upstream (in.)

Ambient Temp 35
Barometric Pressure 30.1
Diameter 0.29
Leak Rate (cfm) 0.0 @ 10" Hg
Static Pressure +0.27" H2O
Filter No. 3002
Impinger Vol. (initial) 200
Impinger Vol. (final) 202
Silica Gel Wt. (initial) 454
Silica Gel Wt. (final) 456

Initial Meter Reading: 471.852

Traverse Point No.	Sample Time (min.)	Sample Vacuum (in. Hg)	Stack Temp. (°F)	ΔP in. H_2O	ΔH in. H_2O	Gas Volume (ft^3)	DGM Temp. IN	DGM Temp. OUT	Filter Temp. (°F)	Last Impinger (°F)
1	1350/2.5	4	49	.17	1.3	473.3	36	36		39
2	1355	4	48	.15	1.2	474.8	37	36		39
3	1357.5	4	47	.15	1.2	476.3	40	36		40
4	1400	4	48	.15	1.2	477.8	42	36		40
5	1402.5	4	49	.15	1.2	479.3	43	36		39
6	1405	4	50	.15	1.2	480.8	45	36		39
7	1407.5	4	51	.19	1.5	482.3	46	36		38
8	1410	4	54	.17	1.3	483.7	46	37		38
9	1412.5	4	56	.17	1.3	485.3	47	37		38
10	1415	5	57	.17	1.3	486.6	47	37		38
11	1417.5	5	58	.21	1.6	488.5	47	37		38
12	1420	5	58	.21	1.6	490.1	48	38		38
13	~~1421~~ 1422.5	5	56	.13	1.0	491.5	43	38		40
14	1426	5	55	.15	1.2	492.7	44	38		41
15	1428.5	5	54	.15	1.2	494.2	46	37		39
16	1431	4	54	.15	1.2	496.0	47	37		38
17	1433.5	5	55	.15	1.2	497.2	48	38		37
18	1436	6	54	.17	1.3	498.6	48	38		37
19	1438.5	5	52	.17	1.3	500.2	48	38		37
20	1441	5	52	.23	1.8	501.9	48	38		37
21	1443.5	5	50	.25	1.9	503.8	48	38		37
22	1446	5	50	.25	1.9	505.7	48	38		37
23	1448.5	5	51	.25	1.9	507.4	48	38		37
24	1451	5	50	.31	2.4	509.4	48	38		37

Final Meter Reading: 509.477

Facility Doe Run
Location Herculaneum, MO
Operator TC
Date 12/4/02
Run No. 1
Sample Box No. APEX
Meter Box No. APEX
Meter Δ H_a 1.9
C Factor 1.0
Pitot Coeff (C_p) 0.84

#9 Baghouse

Diameter (in.)
Downstream (in.)
Upstream (in.)

Ambient Temp 30
Barometric Pressure 30.2 (29.26)
Diameter 0.21
Leak Rate (cfm) 0.0 @ 20" Hg
Static Pressure -10" H_2O
Filter No. 931
Impinger Vol. (initial) 200
Impinger Vol. (final) 203
Silica Gel Wt. (initial) 430
Silica Gel Wt. (final) 434

Initial Meter Reading: 269.403

Traverse Point No.	Sample Time (min.)	Sample Vacuum (in. Hg)	Stack Temp. (°F)	ΔP in. H_2O	ΔH in. H_2O	Gas Volume (ft^3)	DGM Temp. IN	DGM Temp. OUT	Filter Temp. (°F)	Last Impinger (°F)
1	948/950	6	29	.85	1.8	270.8	35	35		29
2	952	6	30	.60	1.3	272.1	36	35		29
3	954	5	32	.55	1.2	273.2	38	35		30
4	956	6	36	.70	1.5	274.4	39	35		30
5	958	7	40	.80	1.7	275.6	41	35		31
6	1000	7	47	.85	1.8	277.1	42	35		30
7	1002/1004	5	36	.80	1.7	278.5	39	36		30
8	1006	5	33	.65	1.4	279.7	42	36		31
9	1008	5	34	.75	1.6	281.1	43	36		31
10	1010	5	38	.85	1.8	282.4	45	36		31
11	1012	5	41	.85	1.8	283.9	46	37		32
12	1014	5	48	1.0	2.1	285.4	47	37		32
13	1016/1018	6	38	.65	1.4	286.6	43	37		30
14	1020	6	35	.75	1.6	288.0	45	37		31
15	1022	6	37	.75	1.6	289.3	47	38		32
16	1024	7	40	.85	1.8	290.7	47	37		31
17	1026	8	44	1.0	2.1	292.3	47	38		32
18	1028	9	48	1.2	2.6	293.9	48	38		32
19	1030/1032	6	37	.70	1.5	295.3	41	39		30
20	1034	7	34	.85	1.8	296.6	45	38		31
21	1036	7	35	.85	1.8	298.2	47	38		32
22	1038	8	39	.90	1.9	299.6	47	38		32
23	1040	8	43	1.0	2.1	301.0	49	39		32
24	1042	8	46	1.0	2.1	302.5	49	39		32
25	1044/46	7	38	.80	1.7	303.8	43	40		31
26	1048	7	33	.75	1.6	305.1	47	40		32
27	1050	7	33	.80	1.7	306.7	47	39		31
28	1052	8	39	.90	1.9	307.9	49	40		32
29	1054	8	44	1.0	2.1	309.5	49	39		32
30	1056	8	43	1.0	2.1	311.0	49	39		32

Final Meter Reading: 311.061

Facility: Herculaneum, MO
Location: Doe Run
Operator: TC
Date: 12/4/02
Run No.: 2
Sample Box No.: APEX
Meter Box No.: APEX
Meter Δ H@: 1.5
C Factor: 1.0
Pitot Coeff (C_p): 0.84

#9 Baghouse

Diameter (in.):
Downstream (in.):
Upstream (in.):

Ambient Temp: 30
Barometric Pressure: 30.2
Diameter: 0.21
Leak Rate (cfm): 0.0 @ 20" Hg
Static Pressure: -1.0" H_2O
Filter No.: 2003
Impinger Vol. (initial): 200
Impinger Vol. (final): 204
Silica Gel Wt. (initial): 434
Silica Gel Wt. (final): 437

Initial Meter Reading: 313.657

1237/39

Traverse Point No.	Sample Time (min.)	Sample Vacuum (in. Hg)	Stack Temp. (°F)	ΔP in. H_2O	ΔH in. H_2O	Gas Volume (ft^3)	DGM Temp. IN	DGM Temp. OUT	Filter Temp. (°F)	Last Impinger (°F)
1	[illegible]/34	7	27	.85	1.8	3150	26	27		23
2	1241	8	26	.75	1.6	316.4	27	26		24
3	1243	9	28	.85	1.8	317.8	30	26		25
4	1245	9	32	.85	1.8	319.1	31	27		25
5	1247	10	37	1.0	2.1	3206	34	28		26
6	1249	10	40	1.0	2.1	322.1	35	28		27
7	1251/53	10	33	1.1	2.3	323.7	33	29		27
8	1255	9	32	.85	1.8	325.2	36	29		27
9	1257	8	33	.75	1.6	326.5	39	31		29
10	1259	8	33	.75	1.6	327.7	40	31		29
11	1301	8	39	.80	1.7	329.0	41	32		29
12	1303	8	43	.80	1.7	330.4	41	30		29
13	1305/1307	8	38	.80	1.7	332.3	38	32		29
14	1309	8	31	.75	1.6	333.6	42	32		29
15	1311	7	32	.65	1.4	334.9	42	32		29
16	1313	8	35	.75	1.6	336.2	43	32		29
17	1315	9	42	.90	1.9	337.6	44	33		29
18	1317	10	45	1.0	2.1	339.0	45	34		29
19	1319/1321	10	39	1.0	2.1	340.7	38	34		29
20	1323	8	36	.70	1.5	341.9	43	34		30
21	1325	8	35	.70	1.5	343.2	44	34		30
22	1327	8	37	.75	1.6	344.5	44	34		30
23	1329	9	43	.90	1.9	345.9	45	34		30
24	1331	10	46	1.0	2.1	347.4	46	35		30
25	1333/35	9	36	.90	1.9	349.1	40	34		30
26	1337	8	33	.70	1.5	350.3	42	34		30
27	1339	7	34	.60	1.3	351.5	43	35		30
28	1341	7	37	.60	1.3	352.6	43	35		30
29	1343	8	44	.70	1.5	353.8	45	35		30
30	1345	8	48	.70	1.5	355.1	45	35		30

Final Meter Reading: 355.180

Facility Doe Run
Location Herculaneum, Mo
Operator TC
Date 12/4/02
Run No. 3
Sample Box No. APEX
Meter Box No. APEX
Meter Δ $H_@$ 1.9
C Factor 1.0
Pitot Coeff (C_p) 0.84

#9 Baghouse

Diameter (in.)
Downstream (in.)
Upstream (in.)

Ambient Temp 30
Barometric Pressure 30.2
Diameter 0.21
Leak Rate (cfm) 0.0 @ 15" Hg
Static Pressure -10" H_2O
Filter No. 2004
Impinger Vol. (initial) 200
Impinger Vol. (final) 204
Silica Gel Wt. (initial) 470
Silica Gel Wt. (final) 473

Initial Meter Reading: 355.516

Traverse Point No.	Sample Time (min.)	Sample Vacuum (in. Hg)	Stack Temp. (°F)	ΔP in. H_2O	ΔH in. H_2O	Gas Volume (ft^3)	DGM Temp. IN	DGM Temp. OUT	Filter Temp. (°F)	Last Impinger (°F)
1	1456/58	8	28	.95	2.0	356.7	27	27		27
2	1500	6	29	.70	1.5	358.1	29	28		32
3	1502	6	31	.75	1.6	359.3	30	28		34
4	1504	8	34	.90	1.9	360.8	33	30		35
5	1506	8	41	1.0	2.1	362.3	35	28		35
6	1508	8	45	1.1	2.3	363.9	37	29		37
7	1510/1512	7	36	.85	1.8	365.1	35	30		35
8	1514	5	34	.75	1.6	366.5	37	30		36
9	1516	6	33	.80	1.7	367.9	39	30		36
10	1518	6	35	.90	1.9	369.3	40	30		36
11	1520	7	41	1.0	2.1	370.8	42	31		36
12	1522	8	46	1.1	2.3	372.4	43	32		37
13	1524/1526	6	35	.80	1.7	373.8	36	32		33
14	1528	5	32	.65	1.4	375.0	40	32		36
15	1530	5	33	.65	1.4	376.3	41	32		36
16	1532	6	37	.80	1.7	377.6	43	32		36
17	1534	6	40	.85	1.8	379.0	44	32		36
18	1536	7	43	.95	2.0	380.5	45	33		36
19	1538/1540	7	38	.90	1.9	382.0	38	33		34
20	1542	6	33	.80	1.7	383.3	44	33		36
21	1544	6	32	.70	1.5	384.6	44	33		35
22	1546	6	36	.80	1.7	386.0	45	34		36
23	1548	6	42	.80	1.7	387.4	46	34		36
24	1550	6	47	.90	1.9	388.8	46	34		36
25	1552/54	7	39	1.0	2.1	390.5	39	34		34
26	1556	6	36	.70	1.5	391.8	44	34		35
27	1558	5	37	.55	1.2	392.9	44	35		36
28	1600	7	41	.65	1.4	393.4	45	35		36
29	1602	7	47	.65	1.4	394.6	45	34		36
30	1604	7	48	.65	1.4	395.9	45	34		36

Final Meter Reading: 395.900

Appendix D - Equipment Calibrations

Dry Gas Meter Calibration Form

Certification Date: 1/10/2003 **Pb (in.Hg):** 30 **Meter Box I.D:** Apex

Orifice Manometer Setting, dH, in.H_2O	Wet Test Meter Volume V_w, ft^3	Dry Gas Meter Volume V_m, ft^3	Temperatures				Time Theta, min.
			Wet Test Meter t_w, F	DGM Inlet t_i, F	DGM Outlet t_o, F	DGM Average t_m, F	
0.5	10.00	9.818	48.0	56.3	50.7	53.5	25.50
1.0	10.00	9.803	48.0	63.0	51.0	57.0	18.25
2.0	10.00	9.786	48.0	67.3	53.3	60.3	13.75
3.0	10.00	9.814	48.0	67.7	54.7	61.2	10.75
3.5	10.00	9.835	48.0	69.7	56.0	62.8	9.75

Orifice Manometer Setting, dH, in.H_2O	Calibration Factor, Y	Orifice Pressure Differential, dH@
0.5	1.028	1.736
1.0	1.036	1.777
2.0	1.042	2.009
3.0	1.038	1.837
3.5	1.038	1.758
Average:	1.036	1.823
Standard Deviation	0.005	0.110
Acceptable Value?	YES!	YES!

*Tolerances for individual Y values+/- 0.02 from average.

**Tolerances for individual dH@ values +/- 0.20 from average.

$$Y = \frac{V_w P_b (t_m + 460)}{V_m \left[P_b + \frac{dH}{13.6} \right] (t_w + 460)}$$

$$dH_@ = \frac{0.0317 dH}{P_b (t_o + 460)} \left[\frac{(t_w + 460) Theta}{V_w} \right]^2$$

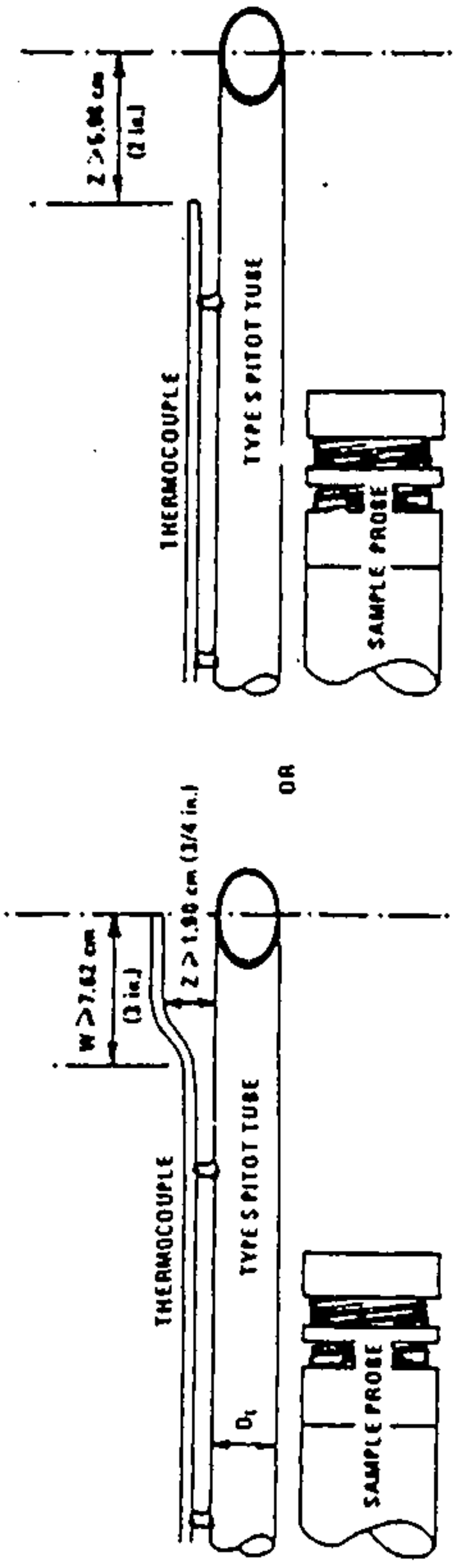


Figure 2-7. Proper thermocouple placement to prevent interference; D_t between 0.48 and 0.95 cm (3/16 and 3/8 in.).

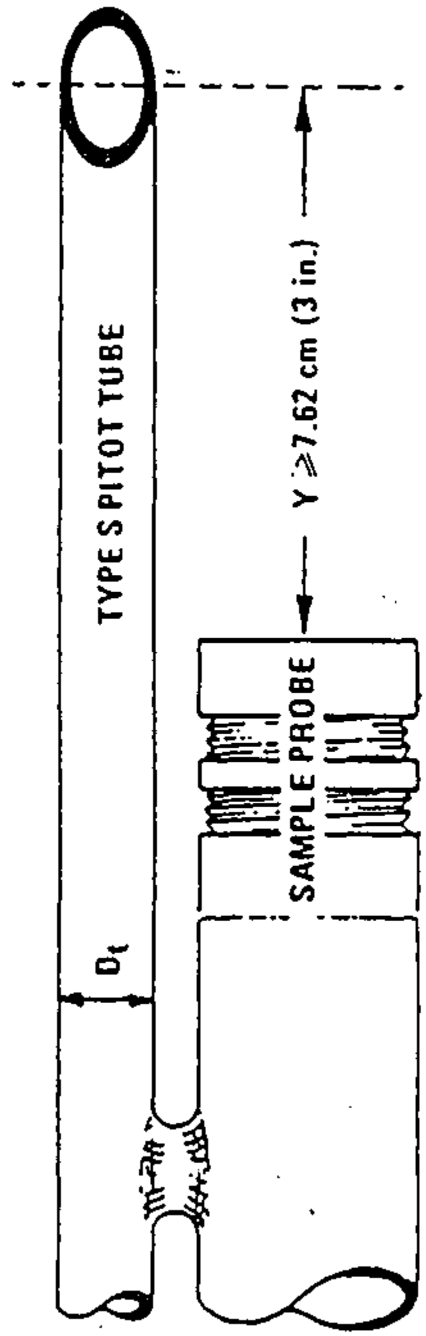


Figure 2-8. Minimum pitot-sample probe separation needed to prevent interference; D_t between 0.48 and 0.95 cm (3/16 and 3/8 in.).

White Star Environmental Pitot Assembly Calibration Data

Pitot Assembly #: thimble Filter assembly

W = 6.035" Z = 2.195" Y = 11.559"

Appendix E - Certifications

Certification

Personnel Qualifications

CERTIFICATION

White Star Environmental Consulting Corporation (WSECC) performed air quality testing at Doe Run Company located in Herculaneum, Missouri on December 3-5, 2002. Three process systems: (1) # 7 Blast Furnace Bldg. baghouse, (2) # 8 Refinery Process Kettles baghouse, and (3) the # 9 Refinery Bldg. baghouse were sampled for particulate matter and lead emissions.

Air quality testing services performed by White Star Environmental pursuant to the terms of the agreement are provided by adhering to sampling and analysis procedures as established by the Environmental Protection Agency in the Code of Federal Regulations, 40 CFR Part 60. No unapproved deviation or alternative procedure was employed during these exercises and the results are considered to be accurate and representative.

William J. Sewell, II
White Star Environmental – President

(for)
Timothy Carey
White Star Environmental – Field Supervisor

January 15, 2003
Date

William J. Sewell, II
President

Summary of Professional Experience

White Star Environmental Consulting Corporation
Position: President
Professional environmental consultant servicing industrial facilities with air pollution related projects including permitting, compliance testing, CEM systems & certifications, etc. Providing air pollution sampling and analysis expertise for industry. Responsible for technical development of Title V permit applications and QA/QC technical documents for EPA compliance on CEMS applications. (1995 – present)

Ramcon Environmental Corporation
Position: Vice President
Responsibilities include management of corporate operations providing EPA regulatory compliance services. Responsibilities include administration and management of professional staff, EPA regulatory adviser, technical writing, generation of new business opportunities, development of services division, QA/QC program & safety management program (1988 - 1995)

Education

B.S. in Chemical Engineering
Christian Brothers University, May 1986

M.S. in Engineering Management
Christian Brothers University, May 1997

Accomplishments, Skills, & Affiliations

- Twelve years of air quality testing project management experience. Projects include air emission testing from boilers, incinerators, furnaces, turbines, etc.
- Member Arkansas Environmental Federation & Air Committee Member.
- Expertise in EPA Title 40 regulations.
- 1990 Clean Air Amendments (CAAA) regulatory specialist (Acid Rain Program, HAPS, Permitting).
- Development of Neural Network Predictive Emissions Monitoring Systems (PEMS) sampling and data collection protocol. Received recognition from national publications for active participation.
- Training seminar for Arkansas Dept. of Environmental Quality on compliance test observation techniques.

Timothy Ryan Carey
Vice President

Summary of Professional Experience

White Star Environmental Consulting Corporation
Position: Vice President
Professional environmental consultant servicing industrial facilities with air pollution related projects including compliance testing, CEM systems & certifications, etc. Providing air pollution sampling and analysis expertise for industry.
(1997 – present)

Ramcon Environmental Corporation
Position: Project Engineer
Professional environmental consultant servicing industrial facilities with air pollution related projects including compliance testing, CEM systems & certifications, etc. Providing air pollution sampling and analysis expertise for industry.
(1995 - 1997)

Education

B.S. in Mechanical Engineering
University of Arkansas, May 1994

Accomplishments, Skills, & Affiliations

- Seven years of air quality testing project management experience. Projects include air emission testing from boilers, incinerators, furnaces, turbines, etc.
- Fluent in EPA Title 40 regulations.
- Expertise in 40 CFR 60, Appendix A&B testing and analysis procedures.
- Participant of Predictive Emission Monitoring Systems (PEMS) development of neural networks as Alternative Monitoring Systems.

Appendix F - Related Correspondence

MDNR Pre-test Protocol

PROPOSED TEST PLAN

Submitted to: MO Dept. of Natural Resources,
Air Pollution Control Program, Enforcement Section
P.O. Box 176, Jefferson City, MO 65102

Date Submitted: ______________________

Attention: Peter Yronwode

Proposed Test Date: December 3-6, 2002

1.) FACILITY INFORMATION:		
Name: Doe Run Company		
Address: : 881 MAIN ST.		
City : Herculaneum	State: MO	Zip: : 63048
Name & title of Contact Person: Rusty Keller		
Phone No. of Contact Person: (636) 933-3097	Fax No.: (636) 933-3150	

2.) AIR POLLUTION SOURCE TO BE TESTED:				
Type of Facility/Source: Primary Lead Smelter and Refinery				
Permit #	FIPS/Plant ID: : 099 / 0003			PORT #
Address/Location:				
Address/Location: North on Hwy 55 Hwy to Herculaneum exit {Next exit past Festus, MO and approx. 30 mi. South of St. Louis, MO}. Come off the Overpass and turn Rt. {East}. Go second Stoplight and turn left on "Old Hwy 21". Travel to top of Hill and turn Rt.. Travel over the Joachim bridge and make first Right. Follow Road to Plant.				
Reason for Test:		Condition of Permit		Consent Agreement
	x	Administrative Order		
		Other (specify)		

3.) TESTING FIRM INFORMATION:		
Name of Firm: White Star Environmental		
Address: P.O. Box 238		
City Olive Branch	State: MS	Zip: 38654
Name & title of Contact Person: Joe Sewell		
Phone No. of Contact Person: (662) 893-3063	Fax No.: (662) 895-1651	
Number of employees of firm:		5
No. of employees actually engaged in air pollution source testing:		4
Organizational chart with names & title of personnel: (please attach)		

3.) TESTING FIRM INFORMATION: (cont.)

Location & description of laboratory facilities:

American Interplex; Little Rock, AR performing lead analysis

White Star Environmental performing particulate matter analysis

Subcontractor(s) utilized by firm for source testing activities: None

Number of air pollution sources previously tested by firm:	1000 +

Sources tested by firm in Missouri in past 3 years (source, test, date): 25

Doe Run – Glover, MO

Univ. of Missouri – Columbia, MO

4.) PERFORMANCE TEST INFORMATION:

	Pollutant	No. of Sampling Points	Total Time per Test Run	No. of Test Runs	Test Method to be Used
1.	PM/Pb – #7 Blast Furnace Bldg BH	30	60 min	3	Reference Method 12
2.	PM/Pb – #8 Refinery Process Kettles	16	60 min	3	Reference Method 12
3.	PM/Pb – #9 Refiner Bldg	30	60 min	3	Reference Method 12
4.	PM/Pb – Main Stack	8	60 min	3	Reference Method 12
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					

5.) GENERAL

A. Sampling Equipment Information:

The manufacturer and model of the sampling equipment to be used by the tester for the performance tests, along with a description of any equipment which may differ from that required by the specified method(s).
PM testing: Nutech Model 2010A Sampling Console

B. Test Procedures:

A description of any test procedures to be used in the conduct of the performance tests which may differ from the specified method(s).

Due to horizontal and large ducts, tester may utilize in-stack filter.

NOTE: Deviations from EPA test methods observed during test procedures will not necessarily be corrected by agency observer and could result in agency rejection of test results.

C. Analytical Procedures:

A description of any analytical procedures which differ from the specified method(s).
None

D. Data Sheets:

A sample of all field data sheets which do not provide the data shown on the example sheets in 40 CFR 60 for the specified method(s). (As previously submitted)

E. Air Pollution Control Equipment: (#7 Baghouse)

Types and manufacturers of all control equipment:
EIGHT (8) 1917 TA-SB Model 144, Series 6P, Wheelabrator Modular Jet III Continuous

Automatic Pulse Type Dust Collectors (in an 8 X 1 arrangement) [S/N 20-4495C]

Design or guarantee efficiency: 0.022 gr/ dry standard ft^3

Design gas volume at full load (acfm): 300,000

Design pressure drop: 6" W.G.

Maintenance schedule and method of record keeping: Per 1997 Missouri SIP Agreement

E. Air Pollution Control Equipment: (#8 Baghouse)

Types and manufacturers of all control equipment:
TWO (2) 1917 TA-SB Model 144, Series 6P, Wheelabrator Modular Jet III Continuous

Automatic Pulse Type Dust Collectors (in an 2 X 1 arrangement) [S/N 20-4495A]

Design or guarantee efficiency: 0.022 gr. / Standard dry $ft.^3$

Design gas volume at full load (acfm): 90,000

Design pressure drop: 6" W.G.

E. Air Pollution Control Equipment: (#9 Baghouse)

Types and manufacturers of all control equipment:
FIVE (5) 1917 TA-SB Model 144, Series 6P, Wheelabrator Modular Jet III Continuous

Automatic Pulse Type Dust Collectors (in an 5 X 1 arrangement) [S/N 20-4495B]

Design or guarantee efficiency: 0.022 gr. / standard $ft.^3$

Design gas volume at full load (acfm): 250,000

Design pressure drop: 6" W.G.

E. Air Pollution Control Equipment: (Main Stack)

(5E)

ITEM #	Process[1] Name	Control Device	Gas Volume [2]	Percent of Total
1a[3]	Sinter Machine	#3 Baghouse	300-350,000 ACFM @290°F	26.3
1b[3]	Acid Plant	ESP; Acid Plant	55,000 AFM @ 175°F	4.8
1c[3]	Misc. transfers; Return Bin	South End Baghouse	25,000 ACFM @ ambient+5°F	2.2
1d[3]	Mixing Drum	Mixing Drum Baghouse	12,000 ACFM @ ambient +5°F	1.1
1e[3]	Claw Breaker; Ross Rolls; Corrugated Rolls; and Euromag	Crusher Baghouse	45,000 ACFM @ 190°F	3.9
1f[3]	Cooler	Cooler Baghouse	110,000 ACFM @ 200°F	9.6
1g[3]	Smooth Rolls	Smooth Rolls Baghouse	15,000 ACFM @ ambient +10°F	1.3
2	Blast Furnaces	#5 Baghouse	500-550,000 ACFM @ 170°F	43.8
3	Dross Plant	Dross Furnace Baghouse	80,000 ACFM @ ambient +10°F	7
-	Main Stack Total (4)	- All Sources	1,130,000 ACFM @ 190°F	100

(1) Each Process is a portion contributing to the main stack.
(2) Estimated flow rate based on equipment design specifications.
(3) Equipment item numbers 1a thru 1g are Sinter Plant related.
(4) Actual total main stack flow is expected to be somewhat lower than the listed as dictated by the specific needs of each process.

#3 Baghouse
- Manufacturer: Wheelabrator Frye
- Model:
- S/N: Equip. #162-300
- Design efficiency: 99.5%
- Design flow acfm: 300,000 - 350,000
- Design Pressure Drop: 8″ W.C. Normal

ESP
- Manufacturer: WHEELABRATOR
- Model: (1) 24/33/5X8/12″ HaRDE Model 35032
- S/N: Contract S/N 3559, DRC equip. #150-525
- Design efficiency: 0.03GR/SDCF all fields, 0.06GR/SDCF w/1 field de-energized
- Design flow acfm: 95,283 Max.
- Design Pressure Drop: +/- 20 W.G. @ 550F continuous, 05″ @ 600F Std. Oper.

Acid Plant Control for SO2
- Manufacturer: CHEMICO
- Model:
- S/N: equip. # 161-XXX
- Design efficiency: (Scrubbers provide additional particulate capture to ESP)
- Design flow acfm:
- Design Pressure Drop:

South End Baghouse
- Manufacturer: WHEELABRATOR
- Model: #2614 RA-SB Model 120 JET III DUST COLLECTOR
- S/N: 20-3260, equip. #150-610
- Design efficiency: 99.5%
- Design flow acfm: 24,000 @ 70F Max Temp. 300F
- Design Pressure Drop: 5″ W.G.

Mixing Drum Baghouse
- Manufacturer: Research - Cottrell, Flex Kleen Corp. (1993)
- Model: 120-WXTC-196 (III)
- S/N: equip. #150-176
- Design efficiency: 99.5%

Design flow acfm: 12,000
Design Pressure Drop: +/-30" W.G., -15" W.G. Oper. Press.

Crusher Baghouse
Manufacturer: Research Cottrell, FLEX-KLEEN Corp.
Model: #120-WMWC-660 (III)
S/N: PO# A-794926, equip. #150-347
Design efficiency: 99.6%
Design flow acfm: 40,100
Design Pressure Drop: +/- 20" W.G., 6"-8" Normal

Cooler Baghouse
Manufacturer: Research Cottrell, FLEX-KLEEN Corp.
Model: BG89125-R2 Model#120-WXWC-1944 (III)
S/N: P.O.#A-794934, equip. #150-349
Design efficiency: 99.6%
Design flow acfm: 131,600
Design Pressure Drop: +/- 20" W.G., 6"-8" Normal

CV22 Baghouse
Manufacturer: Custom Systems
Model: TD64-08
S/N: P.O.#A-201444-25T, equip. #150-349
Design efficiency: 99.5%
Design flow acfm: 3,140
Design Pressure Drop: +/- 20" W.G., 3"-6" Normal

76" Smooth Rolls Baghouse
Manufacturer: Micro-Pulsaire
Model:
S/N: equip #155-515
Design efficiency: 99.5% (0.007 gr/cf)
Design flow acfm: 15,000
Design Pressure Drop: +/- 20" W.C., 6" Normal

#5 Baghouse
Manufacturer: Wheelabrator - Frye Inc.
Model: #1624 Model #264 series 8
S/N: equip. #162-500
Design efficiency:
Design flow acfm: 550,000
Design Pressure Drop: 8" W.C.

Dross Furnace Baghouse
Manufacturer: Amerex
Model:
S/N: equip.#153-440
Design efficiency: 99.7%
Design flow acfm: 80,000
Design Pressure Drop: 8" W.C.

6.) SPECIFIC Emission Source Process/Operation (#7 Baghouse)

Provide a full description of the process/operation being tested for air emissions, to include:

A. Characterization of plant/equipment/process:
The #7 baghouse ventilates the combined Blast Furnace and Dross Plant building fugitives. Two blast furnaces are present at the facility. The furnaces are water-jacketed to within 5 feet of the charge floor, and above that, they are lined with fire-clay brick. Both are equipped with center line offtakes for their process gas streams to a separate #5 baghouse and Main Stack. The furnaces are fed w/ coke & sinter via a shuttle conveyor system and are ventilated by a separate Dross furnace baghouse and Main Stack. Bullion is decopperized in the Dross Plant portion of the building in 4-250 ton kettles that are vented to the #5 baghouse by use of kettle hoods

B. Manufacturer, model & serial numbers of all major components:
Blast Furnaces = St. Joe Lead Co.; N.A. (1965)

C. Rated process/production capacity:
Blast Furnace = 73 concentrate T/Hr @ roughly 75%Pb = roughly 55 Lead T/Hr/2fces.
110 {50%Pb} Lead bearing material T/Hr/2 fce's, 55 Lead material T/Hr/per one furnace.
27.75 Tons of bullion / Hr / furnace X roughly 95% Pb = 26.4 Tons Pb / Hr
Dross Plant = 47 lead bullion Tons / Hr

D. Normal process/production capacity:
Blast Furnace = 55 tons of sinter charge / Hr x 0.48%Pb = roughly 26 tons of Pb produced / Hr/fce

E. Nature and relative % of raw material input to process:
Blast Furnace = Sinter & Secondaries @ 43% to 50% Lead
Dross Plant = Molten Lead bullion @ roughly 95% Lead.

F. Product(s) (with relative % if more than one):
From the Blast Furnaces: Molten Lead Bullion @ roughly 95% lead
From the Dross Plant kettles: Molten Decopperized Lead @ roughly 99% Pb.

G. Type(s) of fuel:	Consumption Rate:
Natural Gas & Petroleum Coke vented to #5 Baghouse & Main Stack	Natural Gas: roughly 8.2 MCF/Hr Petroleum Coke: roughly 4 T/Hr/fce

H. Normal operating schedule:
Normal operating schedule is 24 hours per day, 7 days per week, 12 months per year.

I. Process flow diagram: (please attach):

6.) SPECIFIC: Emission Source Process/Operation (#8 Baghouse)

Provide a full description of the process/operation being tested for air emissions, to include:

A. Characterization of plant/equipment/process:
The #8 baghouse filters air from the kettle hoods in the Refinery and the CV-10 Belt under the Stock Sinter Storage Hoppers. The Refinery is basically a batch process Where kettles are worked in batches of roughly 250 tons per batch before moving to another kettle to work the next step. CV-10 belt is used on an as needed basis.

B. Manufacturer, model & serial numbers of all major components:
Eleven 250-ton kettles
CV-10 belt conveyor

C. Rated process/production capacity:
Refinery Kettles: 163 tons of lead bullion / hour
CV-10 belt: 55 Sinter feed T/Hr/ fce

D. Normal process/production capacity:
Kettles at: 2.5 kettles/day, 26 Ton of lead cast/Hr
CV-10 belt: 40.49 Lead bearing material T/Hr

E. Nature and relative % of raw material input to process:
Molten Lead at roughly 99% Pb

F. Product(s) (with relative % if more than one):
Refined Lead metal @ 99.99% Pb.

G. Type(s) of fuel:	Consumption Rate:
Natural gas heated, *{On separate ventilation system}	N/A

H. Normal operating schedule:
Seven (7) days per week, 24 hours / day, 365 days / Yr

I. Process flow diagram: (please attach):

6.) SPECIFIC Emission Source Process/Operation (#9 Baghouse)

Provide a full description of the process/operation being tested for air emissions, to include:

A. Characterization of plant/equipment/process:
The #9 Baghouse ventilates the Refinery building fugitives. Lead is pumped and laundered into the Refining department, which is equipped with eleven 250-ton kettles. Each kettle is heated by one gas-fired burner which is on a separate ventilation system. Lead is pumped through the sequential kettle series, culminating in delivery of refined lead to casting machines.

B. Manufacturer, model & serial numbers of all major components:
Eleven 250-ton kettles

C. Rated process/production capacity:
Refinery Kettles: 163 tons of lead bullion / hour

D. Normal process/production capacity:
Kettles at: 2.5 kettles/day, 26 Ton of lead cast/Hr

E. Nature and relative % of raw material input to process:
Molten Lead at roughly 99% Pb

F. Product(s) (with relative % if more than one):
Refined Lead metal @ 99.99% Pb

G. Type(s) of fuel:	Consumption Rate:
Natural gas ventilated by separate system	NA

H. Normal operating schedule:
Seven (7) days per week, 24 hours / day, 365 days / Yr

I. Process flow diagram: (please attach):

6.) SPECIFIC Emission Source Process/Operation (Main Stack)

Provide a full description of the process/operation being tested for air emissions, to include:

A. Characterization of plant/equipment/process:
SEE ADDITIONAL PAGES (6A)

B. Manufacturer, model & serial numbers of all major components:
Sinter machine =McDowell-Wellman; F-S306-H (1964)
Blast Furnaces = St. Joe Lead Co.; N.A. (1965)

C. Rated process/production capacity:
Sinter Plant = 270 tons of feed / Hr divide by 2 (returns) = roughly 135 tons of sinter / Hr
Blast Furnace = 73 concentrate T/Hr @ roughly 75%Pb = roughly 55 Lead T/Hr/2fces.
110 {50%Pb} Lead bearing material T/Hr/2 fce's, 55 Lead material T/Hr/per one furnace.
27.75 Tons of bullion / Hr / furnace X roughly 95% Pb = 26.4 Tons Pb / Hr

D. Normal process/production capacity:
Sinter Plant = 90 tons of sinter / Hr x 0.48%Pb = roughly 43 tons of Pb in sinter / Hr
Blast Furnace = 55 tons of sinter charge / Hr/fce X 0.48%Pb = roughly 26 tons of Pb produced / Hr/fce

E. Nature and relative % of raw material input to process:
Sinter Plant = Main Feed Mixture @ 43% to 50% Lead
Blast Furnace = Sinter & Secondaries @ 43% to 50% Lead

F. Product(s) (with relative % if more than one):
Sinter Plant = Sinter @ 43% to 50% Lead
Blast Furnace = Lead Bullion @ roughly 95% lead

G. Type(s) of fuel:	Consumption Rate:
Natural Gas & Petroleum coke	Petroleum Coke: Roughly 4 T/Hr/fce Natural Gas: roughly 14 MCF/Hr

H. Normal operating schedule:
Blast Furnace normal operating schedule is 24 hours per day, 7 days per week, 12 months per year.
Present Sinter Plant normal operating schedule is 24 hours per day, 5 days per week, 12 months per year.

I. Process flow diagram: (please attach):

(6A)

The present normal mode of operation for the Herculaneum facility is to try to achieve maximum production through the use of one furnace operating 24 hours per day, 7 days per week, 52 weeks per year and to operate the Sinter Plant 24 hours per day, 5 days per week and 52 weeks per year. Although the throughput of individual unit processes may vary, the overall plant material throughput is relatively constant.

Exhaust air from the emission sources pass through control devices as listed in the above table before they enter the main stack. The concentration of particulate matter present in the main stack exhaust gas stream represents controlled emissions from all of the individual emission units that contribute to the main stack exhaust gas flow. Similarly, the concentration of lead and other metals in the main stack exhaust also reflects controlled emissions.

By definition, operation of the various emission units listed in the table is not continuous. Rather, it is an on-going sequence of batch-type unit operations that run repeatedly on a 24-hour per day, seven day per week basis. The only exception to this is when equipment is taken down for planned or unplanned maintenance. Due to their relatively small percentage of gas flow contributed to the total stack flow, when some of these processes are down, they have little influence on the total flow and total main stack emissions. The exception to this is when the sinter plant is down.

As shown in the table, the two exhaust gas streams that dominate the total air-flow to the main stack are from the sinter machine and the blast furnaces. These two emission units make up 70% of the total air-flow vented to the main stack. Nearly 27% of this is from the sinter machine operation and more than 44% from operation of the blast furnaces.

The 550ft. main stack is equipped with a test platform at an elevation that is 350 feet above grade. The platform, which surrounds the entire stack, consists of a 4 ft. wide walkway equipped with appropriate handrails and guarding for fall protection. Access to the test platform is via either a small electrically driven elevator or via safety ladder. There are standard 20 amp. Electrical outlets on this 350ft. level landing available for use during testing.

There are four 6-inch diameter (schedule 40) sample ports installed diametrically opposed in the stack at the platform elevation. The stack inside diameter at the elevation of the test ports is 32 feet 10 inches. The sample ports are located at a distance of 272 feet above the highest duct breaching to the stack. Based on the inside diameter of the stack at the test port elevation and the distance between the sample port elevation and the elevation of the stack breaching, the location of the sample ports are greater than 8 diameters and, therefore, meets the USEPA Method 1 specification for ideal stack base to the top, the taper is only 2.76 ft. per 100 ft. of stack height. This slight taper will not, therefore, have any significant effect on the air flow conditions within the stack.

Appendix G - Process Data

BLAST FURNACE FEED DATA SHEET   DATE: 12-3-02

BF# 2   SHIFT: Days   NAME:

CO	CHARGE START	CHARGE TIME COKE		CHARGE TIME SINTER		N	S
11	:	94	3.08	100	150	X	
10	:	188	321	200	143		X
0	4:59	282	341	300	159	X	
1	5:05	374	302	400	245		X
9	5:14	470	303	500	243	X	
0	5:24	564	308	600	213		X
0	5:42	658	312	700	207	X	
25	5:46	752	323	800	145		X
0	6:10	846	315	900	142	X	
27	6:19	940	306	1000	154		X
13	6:43	1034	320	1100	201	X	
13	6:53	1128	316	1200	219		X
Ø	7:17	1222	316	1300	255	X	
9	7:26	1316	301	1400	244		X
Ø	7:36	1410	314	1500	331	X	
Ø	7:51	1504	309	1600	311		X
0	9:10	1598	307	1700	308	X	
Ø	8:32	1692	325	1800	202		X
Ø	8:45	1786	428	1900	148	X	
Ø	9:11	1880	309	2000	155		X
Ø	9:26	1974	348	2100	207	X	
Ø	9:44	2068	236	2200	138		X
10	10:13	2162	211	2300	133	X	
11	10:18	2256	208	2400	127		X
Ø	10:24	2350	210	2500	148	X	
Ø	11:13	2444	214	2600	216	X	
Ø	11:20	2538	224	2673	700		X
	:	2632	226	2700	75		X
	11:59	2724	245	2800	138	X	
38	12:06	2820	257	2900	204	X	

#	CO	CHARGE START	CHARGE TIME COKE		CHARGE TIME SINTER		N	S
31	18	12:13	2914	245	3000	201		X
32		:	3008	234	3100	218		X
33	2	12:31	3102	227	3200	231		X
34	Ø	12:38	3196	223	3300	227	X	
35	49	:	3290	213	3400	230	X	
36		:	3384	212	3500	231		X
37	61	14:11	3478	146	3600	58	X	
38	47	14:14	3572	152	3700	161	X	
39	57	14:18	3666	148	3800	115	X	
40	67	14:23	3760	206	3900	142		X
41	66	14:27	3854	140	4000	136		X
42	52	14:30	3948	135	4000	108		X
43	111	15:20	4042	258	4100	403	X	
44		:	4136	248	4300	241	X	
45	115	15:34	4230	202	4400	239		X
46	103	15:39	4324	221	4500	253		X
47		:						
48		:						
49		:						
50		:						
51		:						
52		:						
53		:						
54		:						
55		:						
56		:						
57		:						
58		:						
59		:						
60		:						

BLAST FURNACE FEED DATA SHEET DATE: 12-3-02

BF# 1 SHIFT: Days NAME: J Adams

CO	CHARGE START	CHARGE TIME COKE	CHARGE TIME SINTER	N	S		CO	CHARGE START	CHARGE TIME COKE	CHARGE TIME SINTER	N	S
Ø	:	1288		X		31		:				
Ø	9:58	1508			X	32		:				
Ø	10:07	1018		X		33		:				
Ø	10:31	1780		X		34		:				
Ø	10:35	1838	100 152		X	35		:				
Ø	10:44 ~~10:40~~		200 228	X	X	36		:				
Ø	10:49	1948	300 222	X		37		:				
Ø	10:54	2058	400 141	X		38		:				
Ø	11:01	2168	500 131		X	39		:				
	:	2278	600 151		X	40		:				
	:	1663	1100	X		41		:				
	1:54	1773 229	1200 404	X		42		:				
	14:04	1883	1300 146		X	43		:				
97	14:51	1993	1400 329	X		44		:				
57	14:56	2052	1500 337	X		45		:				
9	15:10	2213	1600 320		X	46		:				
	:					47		:				
	:					48		:				
	:					49		:				
	:					50		:				
	:					51		:				
	:					52		:				
	:					53		:				
	:					54		:				
	:					55		:				
	:					56		:				
	:					57		:				
	:					58		:				
1	:					59		:				
	:					60		:				

BF CHARGE INTERPRETATION.

COKE 94 → = TOTALIZER COUNTER EACH DIGIT = 20 lbs.

3:08 = → TIME TO RUN CHARGE 3.08 minutes : seconds

SINTER 100 → TOTALIZER COUNTER EACH DIGIT = 200 lbs.

1:50 → TIME TO RUN CHARGE 1:50 minutes/seconds

12-3-02
#7 BAGHOUSE
STACK TEST – TRIBOFLOW READINGS

	TEST #1 TIME	TEST #1 TRIBOFLOW	TEST #2 TIME	TEST #2 TRIBOFLOW	TEST #3 TIME	TEST #3 TRIBOFLOW
1	10:30	2.2	12:22	0.80	14:46	0.8
2	10:34	4.2	12:26	0.80	14:50	0.81
3	10:36	2.5	12:28	0.80	14:52	0.81
4	10:38	1.5	12:30	0.80	14:54	0.82
5	10:40	0.8	12:32	0.80	14:56	0.81
6	10:42	0.9	12:34	0.80	14:58	0.81
7	10:44	0.88	12:36	0.81	15:00	0.82
8	10:48	0.84	12:40	0.82	15:04	0.84
9	10:50	0.84	12:42	0.81	15:06	0.84
10	10:52	0.82	12:44	0.81	15:08	0.82
11	10:54	0.82	12:46	0.80	15:10	0.80
12	10:56	0.82	12:48	0.80	15:12	0.80
13	10:58	0.81	12:50	0.82	15:14	0.81
14	11:02	0.81	12:54	0.82	15:18	0.82
15	11:04	0.81	12:56	0.81	15:20	0.82
16	11:06	0.81	12:58	0.80	15:22	0.82
17	11:08	0.81	13:00	0.80	15:24	0.82
18	11:10	0.81	13:02	0.80	15:26	0.82
19	11:12	0.81	13:04	0.80	15:28	0.82
20	11:16	0.81	13:08	0.84	15:32	0.82
21	11:18	0.81	13:10	0.86	15:34	0.82
22	11:20	0.81	13:12	0.86	15:36	0.82
23	11:22	0.81	13:14	0.84	15:38	0.81
24	11:24	0.80	13:16	0.84	15:40	0.81
25	11:26	0.80	13:18	0.82	15:42	0.81
26	11:30	0.80	13:22	0.82	15:44	0.82
27	11:32	0.80	13:24	0.82	15:48	0.82
28	11:34	0.80	13:26	0.81	15:50	0.82
29	11:36	0.81	13:28	0.81	15:52	0.84
30	11:38	0.81	13:30	0.80	15:54	0.83

IN PROCESS 12-4-0
DAYSHIFT
AND CASTED

LOT CONTROL CARD

LOT NUMBER 7740

DROSS FURNACE KETTLE#: ________ *DATE:* 12-2-02

Vacuum zinc added? Yes____ No____

Amount of new zinc added for desilverizing 0 lbs

Was silver assay on pre-zinc sample high enough to make stubs? Yes____ No N

If yes, how many stubs did you make? 0

Was de-zinc kettle temperature between 950 and 1100 F Yes Y No____

Based on the tail sample, was this kettle successfully dezinced? Yes Y No____

What product are you making? DRI What pump? 19

During casting, estimate amount of lead scrapped due to any reason. 4 Tons

What problems occurred while casting? ________

7740

Work Order #	Description	Completed
		Y N
		Y N
		Y N
		Y N

STAMPING:

D7740
CORR UP

Document Name: Lot Control Card; Document Number: DQP156-009-A
Effective Date: 05/01/2000, Revision #5

IN PROCESS 12-4-0
DAYSHIFT
AND
CASTED

LOT CONTROL CARD

LOT NUMBER 7740

DROSS FURNACE KETTLE#: ______ *DATE:* 12-2-02

Vacuum zinc added? Yes_____ No_____

Amount of new zinc added for desilverizing 0 lbs

Was silver assay on pre-zinc sample high enough to make stubs? Yes_____ No X

If yes, how many stubs did you make? 0

Was de-zinc kettle temperature between 950 and 1100 F Yes X No_____

Based on the tail sample, was this kettle successfully dezinced? Yes X No_____

What product are you making? DRI What pump? 19

During casting, estimate amount of lead scrapped due to any reason. 4 Tons

What problems occurred while casting? ______

7740

Work Order #	Description	Completed
		Y N
		Y N
		Y N
		Y N

STAMPING:

D7740
CORR WP

Document Name: Lot Control Card; Document Number: DQP156-009-A
Effective Date: 05/01/2000, Revision #5

IN PROCESS 12-4-0.
DAYSHIFT
AND
CASTED

LOT CONTROL CARD

LOT NUMBER 7740

DROSS FURNACE KETTLE#: ______ *DATE:* 12-2-02

Vacuum zinc added? Yes_____ No_____

Amount of new zinc added for desilverizing 0 lbs

Was silver assay on pre-zinc sample high enough to make stubs? Yes_____ No X

If yes, how many stubs did you make? 0

Was de-zinc kettle temperature between 950 and 1100 F Yes X No_____

Based on the tail sample, was this kettle successfully dezinced? Yes X No_____

What product are you making? DRI What pump? 19

During casting, estimate amount of lead scrapped due to any reason. 4 Tons

What problems occurred while casting? ______

7740

Work Order #	Description	Completed
		Y N
		Y N
		Y N
		Y N

STAMPING:

D7740
CORR WO

Document Name: Lot Control Card; Document Number: DQP156-009-A
Effective Date: 05/01/2000, Revision #5

12-4-03

TRIBOFLOW READINGS

#9 BAGHOUSE

	RUN #1		RUN #2		RUN #3	
	TIME	TRIBO READING	TIME	TRIBO READING	TIME	TRIBO READING
1	9:48	0.8	12:37	0.72	14:56	0.73
2	9:52	0.75	12:41	0.75	15:00	0.75
3	9:54	0.76	12:43	0.77	15:02	0.74
4	9:56	0.76	12:45	0.80	15:04	0.72
5	9:58	0.77	12:47	0.78	15:06	0.72
6	10:00	0.77	12:49	0.77	15:08	0.73
7	10:02	0.77	12:51	0.77	15:10	0.72
8	10:06	0.77	12:55	0.75	15:14	0.74
9	10:08	0.80	12:57	0.80	15:16	0.75
10	10:10	0.82	12:59	0.82	15:18	0.75
11	10:12	0.78	13:01	0.82	15:20	0.75
12	10:14	0.78	13:03	0.75	15:22	0.73
13	10:16	0.77	13:05	0.72	15:24	0.735
14	10:20	0.65	13:09	0.76	15:28	0.74
15	10:22	0.6	13:11	0.75	15:30	0.76
16	10:24	0.66	13:13	0.75	15:32	0.76
17	10:26	0.68	13:15	0.70	15:34	0.74
18	10:28	0.72	13:17	0.70	15:36	0.73
19	10:30	0.70	13:19	0.75	15:38	0.74
20	10:34	0.73	13:23	0.70	15:42	0.75
21	10:36	0.75	13:25	0.76	15:44	0.80
22	10:38	0.75	13:27	0.74	15:46	0.85
23	10:40	0.77	13:29	0.72	15:48	0.78
24	10:42	0.8	13:31	0.73	15:50	0.78
25	10:44	0.82	13:33	0.74	15:52	0.72
26	10:48	0.82	13:37	0.75	15:56	0.74
27	10:50	0.77	13:39	0.80	15:58	0.78
28	10:52	0.77	13:41	0.80	16:00	0.78
29	10:54	0.72	13:43	0.80	16:02	0.77
30	10:56	0.75	13:45	0.76	16:04	0.75

IN PROCESS 12-7-0
DAYSHIFT
#8
IN PROCESS 12-5
DAY SHIFT
AND CASTED

LOT CONTROL CARD

REFINERY

LOT NUMBER 7741

DROSS FURNACE KETTLE#: ________ *DATE:* 12-2-02 STARTED

Vacuum zinc added? Yes ____ No X

Amount of new zinc added for desilverizing 2056 lbs

Was silver assay on pre-zinc sample high enough to make stubs? Yes X No ~~X~~

If yes, how many stubs did you make? 16

Was de-zinc kettle temperature between 950 and 1100 F Yes ____ No ____

Based on the tail sample, was this kettle successfully dezinced? Yes ____ No ____

What product are you making? ____________ What pump? ________

During casting, estimate amount of lead scrapped due to any reason. ________ Tons

What problems occurred while casting? ____________

Work Order #	Description	Completed
		Y N
		Y N
		Y N
		Y N

STAMPING:

~~D 7741~~
D 7241 J White
CORR

Document Name: Lot Control Card; Document Number: DQP156-009-A
Effective Date: 05/01/2000, Revision #5

IN PROCESS 12-4-02
DAYSHIFT
#8
IN PROCESS 12-5
DAY SHIFT
AND CASTED

REFINERY

LOT CONTROL CARD

LOT NUMBER 7742

DROSS FURNACE KETTLE#: ________ *DATE:* 12-3-02

Vacuum zinc added? Yes____ No ✓

Amount of new zinc added for desilverizing 4012 lbs

Was silver assay on pre-zinc sample high enough to make stubs? Yes ✓ No____

If yes, how many stubs did you make? 12

Was de-zinc kettle temperature between 950 and 1100 F Yes X No____

Based on the tail sample, was this kettle successfully dezinced? Yes X No____

What product are you making? 1500 AL 60 What pump? ________

During casting, estimate amount of lead scrapped due to any reason. ________ Tons

What problems occurred while casting? ________

Work Order #	Description	Completed
		Y N
		Y N
		Y N
		Y N

STAMPING:

C 7742

1500 L
1500 L

7742

Document Name: Lot Control Card; Document Number: DQP156-009-A
Effective Date: 05/01/2000, Revision #5

BLAST FURNACE FEED DATA SHEET   DATE: 12-5-02

#8

BF# 1   SHIFT: Days   NAME: J. Adams

CO	CHARGE START	CHARGE TIME COKE	CHARGE TIME SINTER	N	S		CO	CHARGE START	CHARGE TIME COKE	CHARGE TIME SINTER	N	S
[illegible]	5:09	105	100 352	X		31	220	:	3325 —	3200 55		X
231	5:18	210	200 351		X	32	233	:	3478 —	3300 117	X	
239	5:47	315	300 259	X		33	233	:	3581 —	3400 136		X
[illegible]	5:55	420	400 352		X	34	220	:	3683 —	3500 140	X	
228	6:42	525	500 232	X		35		:				
300	6:49	630	600 [illegible]		X	36		:				
[illegible]	7:5[illegible]	733	700 251	X		37		:				
[illegible]	8:00	836	800 217		X	38		:				
[illegible]	8:07	939	900 243		X	39		:				
199	8:21	1042	[illegible]	X		40		:				
[illegible]	:	1145	1100 [illegible]			41		:				
[illegible]	[illegible]	1248	1200 310			42		:				
210	[illegible]	1351	1300 312			43		:				
	:	1454	1400 248			44		:				
232	9:46	1557	1500 331	X		45		:				
183	10:09	1660	1600 453		X	46		:				
248	10:41	1933	1800 137	X		47		:				
242	10:49	2036	1900 143		X	48		:				
259	11:20	2139	2000 158	X		49		:				
228	11:27	2242	2100 134		X	50		:				
240	11:51	2345	2200 124	X		51		:				
241	12:10	2448	2300 123		X	52		:				
218	12:25	2551	2400 140	X		53		:				
254	12:43	2654	2500 133	X		54		:				
228	12:56	2757	2600 126		X	55		:				
318	1:15	2860	2700 123	X		56		:				
250	1:30	2963	2800 121	X		57		:				
	:	3066	2900 116	X		58		:				
	:	3169	3000 117		X	59		:				
270	2:25	3272	3100 118	X		60		:				

BLAST FURNACE FEED DATA SHEET DATE: 12-5-02

BF# #2 SHIFT: Day NAME: J Adams

#8

	CHARGE	20#/click CHARGE TIME ea. 100 clicks = 10 Ton						CHARGE	CHARGE TIME			
CO	START	COKE	SINTER	N	S		CO	START	COKE	SINTER	N	S
210	1 00	94 / 201	100 / 214	X		31		:				
	:	188 / 210	200 / 305		X	32		:				
	:	282 / 211	300 / 325		X	33		:				
	:	376 / 204	400 / 391	X		34		:				
256	5:28	470 / 210	500 / 349		X	35		:				
307	5:36	564 / 211	600 / 319	X		36		:				
116	6:05	658 / 152	700 / 322	X		37		:				
123	6:14	752	800 / 246		X	38		:				
119	6:27	846 / 158	900 / 246		X	39		:				
112	6:34	940 / 219	1000 / 335	X		40		:				
166	7:00	1034 / 247	1100 / 315	X		41		:				
161	7:07	1128 / 251	1200 / [illegible]		X	42		:				
208	7:31	1222 / 248	1300 / 320		X	43		:				
249	[illegible]:38			X		44		:				
	:					45		:				
	:					46		:				
	:					47		:				
	:					48		:				
	:					49		:				
	:					50		:				
	:					51		:				
	:					52		:				
	:					53		:				
	:					54		:				
	:					55		:				
	:					56		:				
	:					57		:				
	:					58		:				
	:					59		:				
	:					60		:				

Document #: FORM DQP152-021-A, Revision #: NONE; EffectiveDate: 09/30/97

BF CHARGE INTERPRETATION.

COKE 94 → = TOTALIZER COUNTER EACH DIGIT = 20 lbs.

3:08 = → TIME TO RUN CHARGE 3.08 minutes : seconds

SINTER 100 → TOTALIZER COUNTER EACH DIGIT = 200 lbs.

1:50 → TIME TO RUN CHARGE 1:50 minutes/seconds

12-5-2002

#8 BAGHOUSE STACK TEST

TRIBO FLOW READINGS

	TEST 1 TIME	TEST 1 TRIBOFLOW	TEST 2 TIME	TEST 2 TRIBOFLOW	TEST 3 TIME	TEST 3 TRIBOFLOW
1	10:15	8.6	11:50	7.8	13:50	8.6
2	10:20	10.0	11:55	3.6	13:55	5.5
3	10:22	13.0	11:57	3.0	13:57	4.2
4	10:25	16.4	12:00	3.8	14:00	3.8
5	10:27	14.2	12:02	4.2	14:02	3.2
6	10:30	12.0	12:05	8.2	14:05	2.5
7	10:31	10.5	12:07	10.8	14:07	1.8
8	10:35	7.9	12:10	10.5	14:10	1.5
9	10:37	6.0	12:12	7.6	14:12	1.8
10	10:40	9.2	12:15	5.2	14:15	1.4
11	10:42	9.5	12:17	6.3	14:17	1.4
12	10:45	14.2	12:20	7.6	14:20	1.5
13	10:47	13.4	12:21	8.5	14:23	1.5
14	10:52	9.0	12:26	9.2	14:26	1.5
15	10:55	6.5	12:28	10.0	14:28	1.5
16	10:57	7.0	12:31	7.5	14:31	1.5
17	11:00	9.5	12:33	6.2	14:33	1.6
18	11:03	11.3	12:36	6.0	14:36	1.6
19	11:05	12.0	12:38	6.0	14:38	1.6
20	11:07	12.3	12:41	8.0	14:41	1.5
21	11:10	10.4	12:43	9.5	14:43	1.5
22	11:12	8.0	12:46	10.0	14:46	1.5
23	11:15	6.5	12:48	9.2	14:48	1.6
24	11:17	7.2	12:51	8.5	14:51	1.6
25						
26						
27						
28						
29						
30						